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ON SOME CAUSES WHICH INFLUENCE TOPOGRAPHICAL CHANGES AND GEOLOGICAL FORMATIONS IN THE CHANNEL ISLANDS OF CALIFORNIA.

BY DR. LORENZO GORDIN YATES.

During a recent visit to San Miguel, the most westerly of the so-called "Channel Islands," off the coast near Santa Barbara, my attention was attracted to phases of the history of the island, which proved intensely interesting.

The general trend of the coast of California is north-west and south-east, but at Point Conception, about 240 miles south-easterly from San Francisco, the direction changes to east and west, and this bend, with the chain of islands distant about 25 miles, forms the Santa Barbara Channel, running parallel with the Santa Ynez Mountains.

These islands are notable from their having furnished shelter to the ships of their discoverers, the old Spanish navigators commanded by the Portuguese, Cabrillo, who died in about the year 1543, and whose body is supposed to have been buried on San Miguel.

The islands east of San Miguel, are Santa Rosa; Santa Cruz; and the Anacapas.

They are separated from each other by channels of from four to five miles in width; they are of eruptive origin, and their areas are principally occupied by a range of low mountains running parallel with the Santa Ynez Mountains,

and with the coast, forming the longer axis of each of the islands above named.

The prevailing winds of the coast, except in January and December, come from the northwest, and form such a reliable meteorological feature as to be called "The Summer trade Winds." Back of the Coast Ranges of Mountains these winds are scarcely perceptible, except where there is a depression in the highlands upon the coast, where the sea breeze rushes in to fill the partial vacuum caused by the rising of the heated air of the valleys. In these instances the portion of the wind-force deflected from its general direction, follows up the line of the main valley and its tributaries, its force being rapidly diminished as it recedes from the main current.

These deflections are apparent at the Golden Gate; the Pajaro and Salinas rivers; the Santa Ynez and Santa Clara Valleys, and various other points north and south.

At Point Conception the mountains extend to the coast, and if the depression forming the Channel were a heated valley, it would draw a large portion of the current of cold, fog-laden wind to replace its over-heated atmosphere. The cool, temperate, sea-filled Channel offering no such conditions, the wind continues its course, without obstruction, across the mouth of the Channel, a small portion only being deflected in an easterly direction. This follows the Santa Barbara Channel with rapidly decreasing force, and long before it reaches Santa Barbara it is represented by a gentle westerly breeze, of which sailing vessels take advantage in making their runs to and fro, between the mainland and the islands.

The main current of wind continues on its course in the direction of San Miguel and Santa Rosa Islands which it sweeps with unabated force, carrying the dry sand from the windward shores and dispersing it in the form of drifts over the entire surface; and I have been at the west end of Santa Rosa Island when the sand was being blown over from San Miguel like a drifting snow storm, over a distance of fully four miles of intervening waters.

These islands were formerly covered by a dense growth of vegetation, and densely populated by aborigines, but since the

advent of the whites, the aboriginal tribes have become extinct, and the introduction of sheep and cattle, to the pasturage of which they have been entirely devoted for many years, has so far destroyed the vegetation as to render a large proportion of some of the islands barren wastes, and land which formerly supported hundreds or thousands of human beings, is fast becoming occupied by shifting sands of no value whatever.

The principal cause of this desolation is the destruction of the plants by sheep; the thick carpeting of the seashore by Mesembryanthemums and other succulent plants kept the sands confined to the immediate shore line, and trees, shrubs, herbaceous plants and creepers served to protect the soil from the destructive agency of the wind and rain; whereas, large areas of the surface now show no evidence of its former condition other than the presence of countless thousands of the dead shells of a snail peculiar to these islands (*Helix ayresiana* Newc.), the bleaching bones of the aborigines, and the vast accumulations of the refuse of their camps, together with the casts of dead trees and shrubs, whose places in the soil appear to have been filled by concretionary columns of sandstone which stand erect, sometimes projecting from two to four feet above the present surface, like gravestones in a cemetery, showing how the soil in which they grew has been blown away. These again will be covered by sand dunes, which may eventually become solid rock and puzzle geologists of future ages.

These casts appear to have been formed by sand falling into the cavities in the soil, the latter having become hardened by exposure to the action of wind and sun, when deprived of the protection of the growth of vegetation; the dead roots of the shrubs decayed, leaving their impress in the mold; these molds filled with sand during the dry season, would, during the rainy season, hold the water which, filling the interstices, furnished the mineral substance which cemented the grains of sand into a solid mass.

On the northeasterly shore of San Miguel Island is a crescent-shaped harbor, protected from the northwest winds by a ridge of basaltic rock, called Harris Point, which forms the

northern extremity of the island; over this point the wind sweeps with great force, carrying the sand mixed with fragments of shells, *Helix ayresiana,* marine shells and other debris from the rancherias, &c.

The sand beach forming around Cuylers Harbor, above referred to, is composed of sand with a large proportion of fragments of the land shell, and a small proportion of those of marine origin.

Santa Barbara, California,
August 16*th,* 1891.

ON PROBLEMATIC ORGANISMS, AND THE PRESERVATION OF ALGÆ AS FOSSILS.

BY JOSEPH F. JAMES, M. SC., F. G. S. A.

For many years past the subject of the animal or vegetable nature of a large class of fossil bodies has been a matter of discussion between two schools of geologists. One of these considers as fucoids or algæ a certain group of forms whose members do not present any organic appearance, but which in the early days of their study were made to do duty as plants, and which consequently still pose as such. The other class refuses to recognize the fossils as the remains of plants, and point out the analogy they present to worm trails, worm borings, animal tracks or marks of inorganic origin. These schools are represented on the fucoid-side by Saporta, Delgado and others, and on the opposite side by Nathorst, Dawson and others.

The attention of the present writer was first attracted to these fossil forms by their abundance in rocks of Lower Silurian age in the vicinity of Cincinnati, Ohio, the geologists there universally regarding them as plants. During the summer of 1884, while engaged in arranging the collections of the Cincinnati Society of Natural History many specimens were studied; and as supplementary thereto the markings made by various insect larvæ, shells, or by running water upon the mud-flats of the Little Miami river. The result of these studies was a paper on the "Fucoids of the Cincinnati Group," published in the Journal of the Cincinnati Society of Natural History, in October 1884 and January 1885. In this paper some of these so-called fucoids were referred to inorganic causes; many more to trails and burrows, and some few to graptolites. None were considered indubitable algæ. Some of the opinions in that paper require modification, but no additional information has caused the opinion that they are not the remains of algæ, to be changed.

Two subjects of primary importance need to be discussed before any detailed examination of these problematic organisms can be made. These are:—I.—Absence of organic or carbonaceous matter. II.—Probability of the preservation of algæ.

I.—Absence of organic or carbonaceous matter.

The absence of organic matter in the fossil bodies under consideration makes it difficult to decide in many cases what they really are. Their mode of occurrence is usually on the under side of the strata as objects in relief. They are mostly of indefinite and quite variable form, so it is scarcely possible to find any two alike in details. Not only are organic *form* and organic *substance* absent, but the beds in which the greater part of the bodies occur are strikingly deficient in organic remains of any other kind, and while these may be and are abundant in strata both above and below, the beds themselves are nearly barren of any but the problematic fossils.

The absence of carbonaceous matter has been considered by some a strong argument against the vegetable nature of the remains; while the presence of it has, conversely, been regarded as indicating an undoubted vegetable origin. But on the one hand we know of organisms, of unquestioned animal origin, in which not a trace of organic matter is left, the impression or cast alone remaining; and we likewise know of unquestioned vegetable remains which are also in the form of casts; but which are so perfectly preserved that even the delicate venation can be studied and described.

On the other hand there are forms of animal origin, like the graptolites, in which there is abundant evidence of the presence of carbonaceous matter, just as there is in true plants, and some of the graptolites were originally referred to the vegetable kingdom on this account. So that it can scarcely be considered that the presence of carbonaceous matter makes the organisms plants; or that its absence militates against their vegetable nature. But, when the absence of definite form, of carbonaceous matter, of other organisms in the same beds of rock, and their occurrence in demi-relief on the under side of the strata; when all these are taken into consideration, it can

scarcely be denied that the probabilities are strongly against, not alone the vegetable nature of the remains, but also against their being the actual remains of animal forms.

The disposition to regard certain branching fossils as plants, even when all carbonaceous material was absent, has been very general because it was for a long time supposed that worm burrows would not show any tendency to branch. But it is now well-known, as was pointed out by Dawson in 1873, and in much greater detail by Nathorst in 1881, that many worm burrows are habitually branched. This differs, however, materially from the dichotomy of true plants, although it has been confounded with it.

II.—Probabilities of the Preservation of Algæ.

Under the head of the probability of the preservation of algæ in a fossil state, much can be said. It will perhaps not be denied by any geologist, no matter to which one of the two schools he may belong, that algæ must have existed throughout all geological time, and that, too, often in the greatest abundance. This has been insisted upon by Salter (Memoirs of Geological Survey of Great Britain, vol. 3, 1866): by Lesquereux in his various publications (2nd Geological Survey of Pennsylvania, Report J; also Coal Flora, Report P; 13th Annual Report Geological Survey of Indiana; Annual Report Geological Survey of Pennsylvania for 1886, etc.), and by others. The presence of masses of graphite in the Laurentian rocks; of oil and gas in the Trenton and Devonian periods, to say nothing of the mere fact that myriads of animal forms could not have existed without the presence of algæ, is sufficient proof that they once existed. But the questions are: Have they been preserved? What are the chances of their preservation? Are all the forms that have been described as algæ, really such? If not; to what can they be referred? What is their origin? The answer to some of these questions is final as regards certain of the problematical organisms; but the answer to the first two general questions has certainly not yet been given.

The opinion held by many students is frequently biased by the expressed opinion of the first observer or describer of a

fossil. It has frequently happened, therefore, that when a form has been described originally as a plant, this identification has been accepted by subsequent workers, and only after many observations have been made and many treatises written, does the original opinion change. This is well shown in the case of *Scolithus.* Originally described as a plant, it was retained for many years in the vegetable kingdom, and only after numerous investigators had examined it, was it definitely referred to the animal world.

To secure an answer to the query, "what are the chances for the preservation of algæ as fossils?" It becomes necessary to observe what is going on in modern oceans and the ocean margins to-day. In all favorable localities seaweeds occur in wonderful profusion. Some varieties live only between tide marks; others only below tide and to a depth of 15 fathoms; others at still greater depths, the growth of these deeper water forms, however, being limited by the penetration of light, vegetation ceasing entirely at depths between 100 and 200 fathoms. These plants occasionally form great masses in the eddies caused by oceanic currents, and cover many square miles of surface. This is the case with the Sargasso sea in mid Atlantic: the sea of kelp off the Falkland islands, and that off the coast of Japan. Some species are tough and leathery, and have thick stems and long fronds, some of these reaching a length of 300 feet. Some are fine and feathery, branching so as to form innumerable minute divisions. Some are hardly more than masses of jelly; and some are covered with a calcareous coating and are thus more or less hard and horny. The last class, however, are not numerous. They are known commonly as *Nullipores.*

The structural characters of the algæ as a class, are strongly against their preservation under any sort of cover for any long period of time. The tissue is a mass of loosely united cells, often with scarcely more than sufficient coherence to hold together; and even in the tough and leathery varieties, the cells have little consistence, are all of one character, and retain their form for only a short period when buried. The late Prof. Leo Lesquereux studied the possibilities of preservation of algæ,

and he reached the conclusion that marine plants are only rarely preserved in a fossil state. He based his deductions of past conditions upon present ones; and he noted that algæ are at the present time scarcely ever found in any good state of preservation. "The difference," he says, "between the woody or vascular tissue of land plants and the cellular compound of the marine or fresh-water algæ, mere filaments glued together, or imbedded in vegetable mucus or gelatine, explains at once why the remains of fucoids are so rarely found petrified." Further he says: "Nowhere have I been able to find any trace of a deposit of sea-weeds preserved from decomposition under any kind of superposed materials, sand, clay, etc. And, nevertheless in some of the countries visited, the shores in many localities are strewn with immense heaps of those plants thrown out by the waves. Marine vegetables, though they may appear of hard, leathery texture like most of the common species of Fucus, soon disintegrate, and pass into a gelatinous, half-fluid matter, which penetrates the sand, so that the lowest strata of these heaps when exposed to atmospheric action, do not generally preserve traces of their organism for more than one year."

While Lesquereux thus announces his positive belief, Mr. G. F. Matthew says that while the algæ buried in *sand* leave no trace, "in clay the result is different. In the Till and Leda Clays of the Acadian coast, which have considerable antiquity, the writer has seen Polysiphonias and other delicate sea-weeds as well preserved as the ferns and Asterophyllites of the shales of the Carboniferous system."

It is generally acknowledged that organic remains are more likely to be preserved in an area of subsidence than in one that is stationary or rising. Sediment is rapidly accumulated in the first, and animals living in the vicinity are likely to be preserved. It is also probable that animals living on or near the bottom of the ocean have a better chance of being entombed than those floating in the water, so that a certain depth of water and a comparatively rapid accumulation of sediment seem to be two necessary adjuncts for the preservation of organisms in anything like abundance or perfection. The so-

called " Fucoids," and the problematical organisms in general are mostly found in strata whose appearance indicates disposition in shallow water. Now this is in just the position where algæ might be expected to occur, but it is also the place where the chances of preservation are fewest. This seems to be conclusively shown by the almost complete absence of true animal remains from strata where the problematical organisms are most abundant. While fossils occur both above and below this horizon, and frequently in the greatest abundance, the actual layers where " Fucoids " are found are notorious for their barrenness. The fragments which *are* found attest the abrading power of the water and we again see the small chance cellular organisms would have of being preserved, when calcareous bodies of animals are ground to fragments.

On the other hand it should be remembered that shallow flats, exposed, it may be, to the air twice a day, or even covered with a slight depth of water, are admirably situated to receive and retain impressions left by crawling animal forms. Rain drop impressions, too, could be preserved, as well as mud cracks and the excavations made by rills of water on a sloping shore. These have all occured. Rain drop impressions, sun cracked earth, rill marks on the shore, and the burrows or trails of worms and molluscs, are all known from various geological horizons. But true algæ in the older rocks are rare indeed; and the most of those described as such take their place among the much discussed problematic organisms. The probabilities that true algæ are included among the long list of species referred to as plants is almost infinitely small; while on the contrary the chances that what have been so considered are referable to tracks, trails or inorganic causes, are almost infinitely great. Nathorst has pointed out that an algæ in sinking to the bottom of the water, if sufficiently solid to be preserved, would not make a *depression* in the mud, but rather an *elevation*. In reality the depression is what is found in the top of the stratum, while the elevation or cast occurs on the bottom of the next overlying stratum of rock.

CATALOGUE OF THE SHELL-BEARING MOLLUSCA OF PORTAGE COUNTY, OHIO.

By Geo. W. Dean.[1]

The following pages are the result of a somewhat industrious experience of about ten years, with the assistance of friends and experts, both within the state and outside of it. No pretence is made of completeness or perfect accuracy, for such a thing belongs to the impossibilities in the present unsettled and confused state of the nomenclature of this interesting department of the science of Natural History. This confusion is most striking among the fresh water univalves and the Corbiculidæ but it exists in nearly all the genera.

I have no doubt that species new to the county will yet be discovered. I predict that *Unio parvus* Barnes, and possibly *Margaritana hildrethiana* Lea, will be found in the south branch of the Mahoning in the township of Deerfield.

I think also that the Rissoids will be increased by the discovery of new forms.

My thanks are due to S. M. Luther and Geo. I. Streator for valuable aid.

Class GASTROPODA.

Sub-Class PULMONATA.

Order Stylommatophora.

Family Zonitidæ.

Genus *Zonites*, Gray.

Section *Hyalina* Ferrussac.

Zonites arboreus Say.

Common everywhere in woods and under logs. It is naturally an upland species, but it is often found in wet places.

Zonites nitidus Mull.

Not so common as the above but is often found in large numbers in wet places, subject to occasional overflow. This is the largest of our Hyalinas.

[1]Kent, O.

Zonites viridulus Mencke.

Wet and swampy grounds away from running streams. Not abundant.

Zonites indentatus Say.

Habitat moist woods. Not gregarious or abundant. A distinct and beautiful species.

Zonites minusculus Binney.

Rather rare. Damp old pastures around stumps and logs, sometimes in woods. I have found this species in four different localities but do not know how generally it is distributed.

Zonites milium Morse.

Habitat thick woods, in depressions among the moist leaves. Common, but not usually found in large numbers. The smallest of all our zonites.

Zonites ferreus Morse.

A northern species very rare in this latitude. A few examples have been collected by S. M. Luther and Geo. I. Streator in the vicinity of Garrettsville. I have compared it with specimens from Maine and have no doubt of its correctness.

Zonites exiguus Stimpson.

I have collected this species in considerable numbers in an open marsh near my place, under sticks and old fence rails. Not very common.

All of the above are found at Kent except *ferreus.*

Section *Conulus*, Fitz.

Zonites fulvus Drap.

Moist places, and very common.

Section *Gastrodonta*, Albers.

Zonites suppressus Say.

This species is not uncommon but has not been collected in large numbers. It is found in different situations but generally under leaves in moist woods.

Zonites multidentatus Binn.

Habitat same as the above. It is a very beautiful species and has been collected in large numbers by Luther and Streator near Garrettsville, rather common.

Section *Mesomphix*, Rafinsque.

Zonites fuliginosus Griffith.

Rather rare in this county so far as I have observed. On hill-sides in deep woods.

Zonites ligurus Say.

More common than any other species of mesomphix.

Zonites intertextus Binn.

Quite rare and has no existence in this part of the county. From Luther and Streator.

Zonites inornatus Say.

I have collected a few specimens of this species in Shalersville and Hiram townships, but it may be considered rare throughout the county.

Family SELENTIDÆ.

Genus *Macrocyclis* Beck.

M. concava Say.

Common. This genus has its greatest development in the Pacific States, but it is the opinion of Mr. Hemphill, whose field of observation has been very extensive, that all of the recognized species of that region are simply varieties of *concava*. Specimens of *concava* from Kentucky are found to very closely resemble the large forms of *vancouverensis* from Oregon and Washington.

Family HELICIDÆ.

Genus *Patula*.

P. solitaria Say.

Streator reports two localities where this species is found. I know of one. It is in woods on high ground in Hiram township. The shells are small but high colored for the species which is usually rather dull. Gregarious.

P. alternata Say.

A very common and abundant species.

P. perspectiva Say.

Also very common in rotten wood.

P. striatella Anthony.

Rather common in wet places liable to overflow. It resembles the preceding in appearance but is quite different in its choice of location.

Section *Microphysa* Albers.

M. pygmea Drap.

This minute species is not uncommon in woods among damp leaves, but it requires close search to find it.

Section *Helicodiscus* Morse.

H. lineatas Say.

Under old logs, in limited quantity.

Section *Strobila* Morse.

S. labyrinthica Say.

Rather rare in most localities. There is a small variety in my woods near Kent that is depressed and keeled.

Section *Stenotrema* Rafinesque.

S. hirsuta Say.

Very common in wet places.

S. monodon Rack. Var *fraterna.*

Common in woods.

Section *Triodopsis* Raf.

T. palliata Say.

Rather common on heavy soils. Absent on the light soils about Kent. Its habitat is about decaying timber.

T. inflecta Say.

Very rare in this county. More common in Sumit. I found two miles west of Akron a shell in every respect except size like the new species *T. craigini* Call, Kansas, and this leads to the suspicion that *craigini* may prove to be only an umbilicated variety of this species.

T. tridentata Say.

Common. Shells of this species and the following one are small throughout the county, only about 12 mm. greatest diameter while at Cincinnati and further south they are 18 mm. or more.

T. fallax Say.

Much like the above but not as common.

Section *Vallonia* Risso.

V. pulchella Mull.

Common. A circumpolar species common to three continents. The costate variety has not been observed here.

Section *Mesodon* Rafinesque.

M. albolabris Say.

Our most common species. The heavy variety prevails in the northern part of the county, sometimes with the parietal tooth. Only the small variety is found near Kent and this is uniformly without the tooth.

M. thyroides Say.

A common and very distinct species. Like the above the large variety is found only upon heavy soils, and the small variety at Kent.

M. profundus Say.

Not common and it does not occur at Kent. Fine specimens have been collected at Garrettsville and elsewhere.

M. multilineatus Say.

The large variety is rare and only found in the northern part of the county. The small variety is not uncommon at Kent. The variety *rufus* is occasionally found, but the plain unbanded variety so common in some places does not occur in the county.

M. sayi Binn.

A small variety of this species has been found along Tinker's Creek in Cuyahoga county, but only one specimen is known from this county. Collected by S. M. Luther.

M. dentifera W. G. Binney.

A single specimen reported from Hiram township by Mr. Luther. The determination may well be considered doubtful from the fact that there are so many forms of *albolabris* that this single specimen may be a sport or abnormal. It is the opinion of some well informed conchologists that *major, exoleta, andrewsi,* and this species are only some of its varietal forms. It is certain that the dividing lines are hard to find.

Family ACHATINIDÆ.

Genus *Ferrussacia* Risso.

F. subcylindrica Linn.

Not yet discovered in any numbers. A few isolated specimens only have been collected.

Family PUPIDÆ.

Genus *Pupa* Lam.

P. pentodon Say.

Most or all of the specimens I have seen are what is known as *P. curvidens* Gld. I have no doubt that both forms occur in the county. It is extremely variable and I do not with my present knowledge regard the latter as a distinct species. It is a common species and is found in localities very different in character.

P. contracta Say.

Common in wet places under decaying wood.

P. corticaria Say.

Inhabits bark of decaying logs as its name indicates. Quite rare here; I have only found six specimens in ten years.

Pupa edentula Drap.= *Vertigo simplex* Gould.

Not common. Attached to decaying wood and under leaves. Best time for collecting this species is late in the fall. *P. alticola* Ing. is probably identical with this.

Genus *Vertigo* Muller.

V. bollesiana Morse.

In swamps. Rare.

V. ovata Say.

Rather common in wet places on logs and sometimes stones.

V. milium Gould.

Abundant in some places on decaying wood and among leaves.

Family SUCCINIIDÆ.

Genus *Succinea* Drap.

S. ovalis Gould.

Very common.

S. avara Say.

Also a very common species. It is usually covered with a black wooly substance easily removed with a brush.

S. aurea Lea.

Not recognized here. Collected at Garrettsville by Mr. Luther.

S. obliqua Say.

Found sparingly in low grounds.

S. totteniana Lea.

Not common. This is the only succinea that I have collected on uplands. It is usually considered a variety of *obliqua*, but its decided green color and different habitat would indicate that it is at least as good a species as some others.

Family AURICULIDÆ.
Genus *Carychium* Müll.

C. exiguum Say.

An abundant species attached to bits of decaying wood in localities like the preceding.

Family POMATIOPSIDÆ.
Genus *Pomatiopsis.*

P. lapidaria Say.

Common along the borders of streams subject to overflow, along with *Z. nitida* and *Succinea avara.* This family is not usually placed among the Pulmonata. I give it this place because it is undoubtedly a land species.

Family LIMNÆIDÆ.
Genus *Limnæa* Lamark.

L. columella Say.

Not uncommon in stagnant water.

L. casta Lea.

A much smaller shell. Habitat the same and thought to be a variety of *columella.*

L. decidiosa Say.

Very common and abundant. Our smallest Limnea.

L. humilis Say.

Much like the preceding only a little larger, common.

L. caperata Say.

A more robust species than the preceding but almost equally common.

L. kirtlandiana Lea.

There is much confusion about this species. The type was evidently only about half grown. The mature shell is quite common and it may prove to be only a slender form of the following.

L. palustris Müll.

I do not know that this species has been collected here but I think it has and I have no doubt of its existence in the county.

L. reflexa Say.

I have not seen it here but Mr. Streator reports it rather common at Garrettsville.

Genus *Bulinus* Adanson.

Bulinus hypnorum Linn.

Not uncommon with habitat like the Limnæas in stagnant waters.

Genus *Physa* Drap.

Physa heterostropha Say.

If Mr. Say had placed everything under this head that he could not place elsewhere the result would be about what we find it; an extremely variable and abundant species.

Physa sayi Tappan.

Physa zordii Baird.

Physa ancillaria Say.

All found here and all may prove only varieties of *heterostropha.* I have collected the latter in Stewart's Lake together with *ancillaria* and more than half were doubtful as to which species they belonged. I regard *ancillaria* as only a variety.

Physa gyrina Say.

Equally variable with *heterostropha* and almost as common.

Physa ampullacea Gould.

Rare. This seems distinct but is said to be only a variety of *gyrina*.

Physa niagarensis Lea.

Reported by Streator from Camp Creek north of Garrettsville but I have not seen the shells. Shells collected at Akron for this species are undoubtedly *heterostropha*. The true *niagarensis* is very heavy and very white, and not half the size of *heterostropha*. Very uniform in size and appearance.

Genus *Planorbis* Guettard.

P. trivolvis Say.

Common but does not develop its full size here.

P. bicarinatus Say.

Common. Also small.

P. campanulatus Say.

Not uncommon.

P. corpulentus Say.

Doubtfully determined.

Section *Gyraulus* Agass.

P. albus Mull.

P. deflectus Say.

P. parvus Say.

P. exacutus Say.

All common.

Section *Segmentina* Fleming.

P. armigerus Say.

An abundant and very distinct species.

The following fresh water univalves are not classed with Pulmonata.

Family VALVATIDÆ.

Genus *Valvata* Mull.

V. tricarinata Say.

A very common species in streams.

Family STREPOMATIDÆ.

Genus *Goniobasis* Lea.

G. depygis Say.

Very common and abundant in all the larger streams.

Family Rissoidæ.

Genus *Bithynella* Moquin Tandon.

B. nickliniana Lea.

Known from Tinker's Creek only.

Genus *Amnicola* Gld. and Hald.

A. pallida Hald.

Tinker's Creek.

The two species last named were collected by Mr. Pettengell of Hudson and I can give no particulars about them.

A. porata Say.

A. parva Lea.

These two species are common at Kent.

A. cincinnatiensis Anth.

Lake Brady, Kent. The determination of this species is doubtful.

Family Paludinidæ.

Genus *Melantho* Bowdich.

M. integra Say.

M. decisa Say.

M. decisa var. *rufa* Hald.

All these and probably others are found in our streams but of there being more than one species I have grave doubts. Chas. T. Simpson the able Assistant Curator at the National Museum entertains the opinion that there is but one species of Melantho in the whole country.

Family Ancylinæ.

Genus *Ancylus* Geoffroy.

A. rivularis Say.

Adheres to stones and is common in many of the streams. Streator.

A. parallelus Hald.

Not uncommon in sluggish waters. Plentiful in the Cuyahoga river on stems of *Pontederia cordata.* Streator.

CLASS LAMELLIBRANCHIATA.

Family Unionidæ.

Genus *Anodonta* Cuvier.

A. edentula Say.

A common and well marked species.

A. lacustris Lea.

Not common. Lake Brady.

A. ferrussaciana Lea.

Reported by Luther and Streator from Silver Creek. I have no means of knowing whether the determination is correct.

A. salmonea Lea.

Cuyahoga river near the Geauga line. This shell is identical with specimens from Ashtabula County that have been submitted to Geo. W. Tryon and Samuel H. Wright and identified as this species. The whole interior of adult specimens are colored a deep salmon, apparently caused by a constitutional disease of the animal. It is, in some places very abundant in sluggish streams.

A. subcylindracea Lea.

An abundant species in all of the larger streams.

A. pavonia Lea.

The typical form is rather common in the Cuyahoga river. A fine radiated variety is found in the Little Mahoning.

A. grandis Say.

I have fine large specimens of this species from a small stream in Windham township.

A. decora Lea.

This is a very beautiful shell but evidently only a smaller form of *grandis.*

A. fragilis Lam.

I am unable to see any value in this species. It is probably another form of *grandis.*

A. pipiniana Lea.

A set of this species is now in good condition, in the Lea collection at the National Museum from Lake Pepin in this township. Superficial examinations have not resulted in its re-discovery.

A. plana Lea.

Immense specimens of this species over eight inches long inhabit a small pond in Stratsboro township.

A. imbecilis Say.

Very rare here. One specimen from Lake Brady and one from a small pond in Franklin township. They have not the beautiful bluish green tint of Ohio river specimens. Recently Mr. Streator reports this species in considerable numbers from the Cuyahoga river in the north part of Hiram township.

Genus *Margaritana* Schum.

M. rugosa Lea.

This robust and plentiful species in the larger streams is comparatively rare here, but I have seen it in the Cuyahoga and it is probably found in Silver Creek and other tributaries of the Mahoning.

M. complanata Lea.

In Silver Creek, but not abundant.

M. marginata Say.

In Silver Creek and doubtless other branches of the Mahoning, but not very common.

Genus *Unio* Retz.

U. coccineus Lea.

Silver Creek, Windham township.

Unio gibbosus Barnes.

Silver Creek, Windham township. Common.

U. luteolus Lam.

Common and abundant in all the larger streams.

U. nasutus Say.

Common in many of the lakes and small streams and abundant in the Cuyahoga.

U. pressus Lea.

A very common species.

U. undulatus Barnes.

Silver Creek, Windham and doubtless other tributaries of the Mahoning.

U. occidens Lea. Branches of the Mahoning but not abundant. This form of *occidens* is identical with *U. subovatus* Lea.

Family CORBICULIDÆ.

Genus *Sphærium* Scopoli.

S. sulcatum Lam.

Common at Kent.

S. solidulum Prime. Kent.

S. striatinum Lam. Kent.

S. stromboideum Say.

Not common. Garrettsville.

S. occidentale Prime.

Not common. Kent.

S. truncatum Kingsly.

Kent. There is some doubt about the determination of this species.

S. fabalis Prime.

Fine specimens from Geo. I. Streator at Garrettsville.

S. securis Prime. Rare at Kent.

S. rosaceum Prime.

This species undoubtedly occurs here, but like the preceding is rare.

S. partumeium Say.

Genus *Pisidium* Pfr.

P. abditum Hald.

Found sparingly in swamps.

P. compressum Prime.

Abundant here in the Breakneck Creek. Fine large specimens.

THE CEREMONIAL CIRCUIT OF THE CARDINAL POINTS AMONG THE TUSAYAN INDIANS.

BY J. WALTER FEWKES.

During the progress of the secret ceremonials which are performed in the Kib-vas or Estufas at Hual-pi, and other pueblos of the old province of Tusayan, it is customary for a priest to pass on the north side of the fire-place as he approaches the altar, and on the south as he passes from the altar to the ladder. This custom is conscientiously followed by the older priests, especially when taking part in important ceremonials, and I have seen novices, and even old priests corrected and sent back when they had violated this simple kib-va custom. Has this usage[1] a meaning and if so what is it? I cannot answer these questions[2] satisfactorily, but I can show that the custom permeates most of their religious ceremonials, and that it makes its appearance in many different forms. It may shed some light on our knowledge of the meaning of this usage if some of the instances in which it appears in ceremonials be mentioned. Possibly kindred facts may suggest at least a theoretical explanation.

It is necessary at the very threshold of the subject to define the Hopi conception of the position of the cardinal points. The Hopi[3] or as they are generally called the Mokis have six points which they recognize in their ceremonial observances.

[1] This custom was almost simultaneously noted by myself and Mr. T. G. Owens in our work as members of the Hemenway Southwestern Archæological Expedition. Mr. Owens will later, in a publication on certain ceremonials which he especially studied, call attention to other examples of the ceremonial circuit which he has observed, and I shall describe it in detail in a memoir which I have in preparation.

[2] I have, however, the names of the Kat-chi-nas who are said to sit at each cardinal point.

[3] The priests at Hual-pi strongly object to being called "Mokis." Mo-ki in their language means "dead." Their true name is Ho-pi-tuh-shi-nuh-mo, peaceful people, Shi-nu-mo simply meaning people. The Mexicans are called Kas-til-shi-nu-mo; Navajos, Ta-shab-shi-nu-mo, etc. I have not found a hieratic and demotic language, among the Hopi, and therefore cannot follow Bourke's suggestion as to the possible origin of the "ancient language." There are many archaic words as in the song sung by the Antelope priest, Tci-no at the Snake Dance, but he himself says that he does not understand the meaning of the words.

They have the four cardinal points to which are added up and down. These directions are always mentioned by them in the following order: north, west, south, east, up and down. Our remarks deal with the four points first named.

These four directions strangely enough do not correspond with the true cardinal points. The so-called Kwi-ni-wi-ke of the Hopi is neither the magnetic nor the polar north, but about northwest, or 45° west of north, and the other points vary in the same ratio. Their cardinal points therefore are really northwest, southwest, southeast and northeast. It does not seem in place here to discuss why these people or their priests have chosen these as their ceremonial cardinal points. I believe a ready explanation is found in the orientation of their kib-vas, which in turn depends on the extension of the mesa[1] upon which Hual-pi is situated. It is true that none of the kib-vas in this pueblo are oriented north and south by the meridian, but all five are placed northeast southwest. The ceremonial[2] part of the kib-vas is therefore situated at the southwest end and the spectator's region on the northeast.

Consider now that the walls have the position which they do, and one can readily see, I think, why the position of those walls should determine the ceremonial cardinal points.

The relationship of colors to the cardinal points, which differs among American races, varies slightly in the two pueblos Hual-pi and Ha-no, Tusayan towns situated only a few hundred yards apart on the same mesa. It must be remembered however, that the people of Ha-no are Western Tewans and not true Hopi. This fact is interesting as showing how tenacious the Tusayan Tewans are, not only of their language but

[1] Or speaking more accurately, on the direction of the lines of fissure of the rock of which the mesa is built up. Studies of the kib-vas of the other mesas would throw light on this point.

[2] By the ceremonial part of the kib-va is meant that portion surrounding the Si-pa-pu or opening symbolic of the opening, out of which in the time of the ancients, the races of men emerged. This opening does not exist however in all kib-vas, but it is easy to recognize the ceremonial part in such by the position of the fire-place. The visitor's portion is always raised a few inches above the ceremonial region and it is upon it that one always steps as he passes from the ladder into the chamber of the kib-va.

also of minor religious conceptions. I have found the same to run through many of their customs and beliefs.[1]

In a comparative study of the directional colors of the Hopi with those of other tribes we must remember that yellow corresponds not to north or west, speaking of the true direction, but to northwest. The following colors correspond to the four cardinal points, [calling to mind that the Hopi north is really northwest,] north, yellow; west, blue [represented ceremonially by malachite green[2]]; south, red; east, white. The reason I translate their word *kwi-ni-wi-ke* for the first direction, north, is because they say their north is the same as the American, but differs from it in direction. At Ha-no the colors are the same except that yellow north, and blue west are interchanged; with them north is blue and west is yellow as among eastern Tewans according to Bandelier. In what follows I confine my remarks to the conception of colors and directions used by the Hopi of Hual-pi.

Whenever these four colors are used symbolically they are used in the same order: yellow, blue, red and white. Whenever offerings are made to the four cardinal points they are made in the corresponding circuit, north, west, south and east. Let me cite a few examples of each which may illustrate, possibly establish, my position.

The ceremonial circuit is constantly followed in the preparation of so-called medicine. When a priest pours the liquid of which it is made into the terraced rectangular bowl, preparatory to placing the other ingredients in it, he pours the fluid first on the north side, then on the west, then on the

[1] A most interesting problem is suggested by the proximity of peoples of Hopi and Tewan descent. The time when the Tusayan Tewans separated from the eastern branch is known historically and tradition tells us why they chose the site for their town which they now occupy. Bringing with them their own mythology they found a similarity between it and that of the Ho-pi, and at once recognized the equivalents of their mythological conception. It would be an interesting research to study the linguistics of the Tusayan Tewans as compared with the eastern to determine the character of the modifications brought about in two centuries, and to find out in these instances where the eastern and western branches have a common name for a deity what Hopi mythological personage the Tusayan branch regard as the equivalent.

[2] When green is mentioned in this article, blue is the color which is in reality meant. Malachite gives a convenient material for paint and, when ground, for sand mosaics, but when used represents blue, I think, in all cases. Diamond dye blue, symbolic of the west, is sometimes used in the ornamentation of dolls or te-hus.

south and then on the east side of the bowl. This I have repeatedly seen performed by many different priests. I have witnessed it in the kib-va exercises of the farewell [*Ni-man*] kat-chi-na, the secret exercises performed by the antelope assemblage at the time of the Snake Ceremonials,[1] in the observances of the flute fraternity and in the cryptic celebration of washing the snakes, which occurs at noon on the day of the Snake Dance. In all instances the liquid is poured into the medicine bowl in the sequence of cardinal points mentioned above. When the sacred meal and cornpollen is added to the liquid in the bowl the same circuit is followed, the priest first throwing a pinch to each point before placing another in the bowl itself. When, as in the *Ni-man kat-chi-na*, the priest, In-ti-wa, washes the crystals and shells from the six ears of corn into the medicine, he takes up first the corn ear at the north of the bowl and then the others in ceremonial circuit. When these ears of corn were laid in their radiating position which they occupy about the bowl, the same sequence was followed and when the rock crystals were placed upon each ear the same law was followed. The greatest care is always exercised when ingredients are placed in the medicine bowl during a ceremony to follow the law indicated.[2]

The ceremonial circuit of the cardinal points is also followed in those observances in which asperging takes place. During the complex ceremony in the Mung-kib-va, performed by the antelope priests at the celebration of the Snake ceremonies, Ha-hau-ly, the pipe lighter, dips his aspergill into the medicine bowl while the traditional songs are being sung and after asperging the sand mosaic altar throws medicine to the north, then to the west, then to the south and then to the east.* This he does in each of the sixteen songs which the antelopes sing continuously in this ceremony.

[1] A memoir on the nine days ceremonial known as the Tcu-a-ti-ki-bi, the last day of which has been often described as the Snake Dance, in which the observances and the traditions connected with them will be considered, is in course of preparation by Mr. A. H. Stephen and the author.

[2] Most interesting illustrations of the ceremonial circuit occur in the cryptic celebration of "Washing the Snakes," prior to the last day's celebration of the Snake Dance, and in the preparation of the liquid (medicine), used by the Snake priests in the manufacture of the clay pellets which they wear tied to their bandoliers.

The instructive ceremonies which take place on the morning following a celebration known as the Ni-man kat-chi-na to which reference has already been made, and which I have witnessed in two of the Tusayan pueblos, have many examples of the law of the circuit of the cardinal points. It is customary at this time for four persons, three of whom are dressed as Kat-chi-nas, to stand facing the kib-va entrance at the four cardinal points. At a certain time the leader walks around the kib-va entrance, throwing a little water to each of the four directions. After him follow the others, but all move about the kib-va opening in a direction opposite the hands of a watch. Later the same persons march around the entrance to the kib-va and pour liquid into a bowl held up by a priest who stands on the lowest rung of the kib-va ladder. In performing these and similar services they pass in the same direction, and all ceremonies involving the four points begin at the same side which is always that referred to as the Hopi north. All the offerings which the kat-che-nas hand into the kib-va, and all those which the priest within throws out follow the same ceremonial circuit which I have described. The priest himself inside the kib-va, in casting the meal out of the entrance upon the Kat-chi-nas, observes the same order. Later in this observance, when the kat-chi-na chief emerges from the kib-va to accompany those outside to the crypt in which the offerings are deposited, he stands on the roof of the hatchway of the estufa and throws a pinch of meal first to the north, then to the west, then to the south and last of all to the east. The other priests who follow do the same, and there are many instances where offerings are made in the same circuit in this instructive service which celebrates the departure of kat-chi-nas or "sitters" to their home in the Francisco Mountain. I have observed the ceremonial circuit in the formal smoking which precedes and follows most kib-va observances. I have watched several of the more conservative priests in the ceremonial smoking,[1] and

[1] Many interesting things might be mentioned in regard to the ceremonial smoking among the pueblos, not the least interesting of which are the methods of passing the pipe and the terms of relationship exchanged, their interpretation of the act of smoking and the love connected with it, but I reserve this for a more extended account.

have always noticed that after having puffed the smoke upon the sacred things on the altar, they send a whiff to each of the cardinal points in the ceremonial circuit.

In the midst of some of the most sacred ceremonies of preparation of medicine it is customary in certain observances to make four marks with sacred meal on each wall of the house, on the ceiling and floor. During the midnight exercises of the Flute Observance and in the woman's dance, La-la-kon-ti, as well as in several other ceremonies this has been observed. When the priests make their four marks on the walls, they always begin with the north and follow the ceremonial circuit, ending with the floor.

In the Snake Celebration the planting of the prayer plumes is entrusted to one of the four chiefs of the antelopes, who places four each day in appropriate shrines, one at each of the four cardinal points. To do this he makes a course around the mesa, the radius of which diminishes each day until the last when he does not leave the top of the mesa itself. In making these runs to deposit the plumes he follows the ceremonial circuit, beginning with the shrine at the north and ending with that at the east.

The snake priests plant their prayer sticks and hunt on four consecutive days for the snakes used in the dance, first to the north, then to the west, then to the south and finally to the east of the mesa on which the pueblo stands.

It is the custom of the Tusayan pueblos to celebrate a solemn ceremony at the time of the Flute Festival[1] in which the cloud god, O-man-a, personified by one of their priests, deposits prayer plumes in the bed of their large springs and takes offerings from the same. At a most impressive time in this ceremony he wades about the spring, neck deep in the water, four times each in the direction necessitated by the ceremonial circuit.

[1] This celebration lasts nine days and is observed on alternate years with the Snake Dance in Hual-pi and Mi-shon-o-vi. It was observed last summer in Shi-pau-lo-vi, Shi-mo-pa-vi end O-lai-bi. I had the good fortune to study it in the first mentioned pueblo and to be initiated into the priesthood in that place. The last day of the celebration called the Ley-la-tak I have partially described in another place (Journal of American Folk Lore, a Suggestion as to the Meaning of the Moki Snake Dance).

The above are but a few of many examples which might be mentioned of ceremonies in which the circuit is followed. The evidence from the use of colors substantiates that already given above. The priest of the Antelope Assemblage, in making the sand mosaic picture in the Mung-kib-va a few days before the Snake-Dance, first makes the yellow border, then the green, then the red and then the white.[1] The north line of the yellow is followed by the west of the same color, then the south and then the east. The same sequence of colors occurs when he outlines and makes the body of the semicircular clouds in the centre of the mosaic (dry painting). The lightning serpents of the four colors are made in the same order of the colors. Colored disks on small bushes are thrown into the kib-va by the four persons who stand outside on the morning after the *Ni-man-kat-china.* First the yellow, then the green, then the red and then the white disks are thrown in in this observance.[2]

In the construction of a pathway of sand and meal across the floor in the Flute Festival four materials are used which correspond with the cardinal points. They are laid on the floor in the sequence corresponding to the ceremonial circuit, north, west, south and east.

Six bird effigies are laid along this line composed of sand, fine meal, coarse meal and corn pollen. These bird figures correspond with the cardinal points, and that named for the north is placed in position first, the others following the ceremonial circuit.

It is interesting to note that the ceremonial circuit is opposite that of the sun in its daily course in the sky. It is proba-

[1] Wi-ki, the Antelope priest, is not always careful to follow this order in placing the colored sands in the sand mosaic (dry painting), but that order is intended, and is generally followed.

[2] The association of colors of opposite directions in certain ceremonials is interesting. For instance in these disks the four white are spotted with green dots, the four green with white, the four yellow with red and the four red with yellow spots. In the same way the four rattlesnakes on the black border of the sand mosaic of the snake assemblage in the snake dance have the head and body of the white snake marked by a green border, the green snake with a white, the yellow with a red, and the red snake with a yellow outline. The same is true of the necklaces of the snakes when present, and the lines indicating rattles. In the lightning snakes of the altar of the antelopes these zigzag figures both male and female have a black border.

bly more than a coincidence that it is the same circuit which the snake and antelope priests take when they move about the place, and where the latter carry the snakes in their mouths. It is generally the same circuit adopted by some of the Kat-chi-nas when they turn in the dances, viz: opposite the motion of the hands of a watch.[1]

It is not possible in a short notice to develop the idea of a fixed ceremonial circuit which is rarely violated. To do so as I would wish, necessitates long descriptions of ceremonies, the names even of which are new to ethnological students. It is possible here to hardly do more than make the barest statements, which will later be substantiated when the ceremonial events are minutely described. The custom of entering and leaving a kib-va, or of passing the fire-place on a certain side is but one illustration of a law which finds expression throughout all the religious customs, secret and public, of the Tusayan Indians. It would be interesting to see whether other American races have the same ceremonial circuit of the cardinal points. My reading has shown me that in some instances they do not.

[1] It is not however always the direction in which the Kat-chi-nas turn in their dancing, for often they turn half way around in this direction and then return to the same position in an opposite way. Upon this point more observations are needed. In most instances it is the course which the procession of Kat-chi-nas follow in Hual-pi when they march from one place to another, between dances. While there are a few exceptions to the law of ceremonical circuit they are not numerous enough to indicate the existence of any other direction of the circuit.

THE ASH-GRAY HARVEST-SPIDER.

By Clarence M. Weed, D. Sc.

The Ash-gray Harvest-spider (*Phalangium cinereum* Wood) occurs over a large portion of the northern United States, and is the species most commonly found about sheds and outbuildings. It is the only one of the harvest-spiders described by Say and Wood that is still retained in the genus Phalangium.

LITERATURE.

This species, like many others of the family, was first described in Dr. Wood's paper published in 1868 in the Communications of the Essex Institute (vol. vi, pp. 25–26, 39; fig. 5) under the name by which it is yet known. The author had received a large number of specimens collected in northern New York.

Aside from a bibliographical reference by Professor Underwood, occurring in the *Canadian Entomologist* in 1885 (vol. xvii, p. 168), no notice of the species appears in our literature until October, 1887, when the present writer called attention, in the American Naturalist (vol. xxi, p. 935), to the fact that this species comes properly in the genus Phalangium as restricted by Simon. Two years later I again treated of the species in my Descriptive Catalogue of the Phalangiinæ of Illinois (*Bull. Ill. St. Lab. Nat. Hist.* vol. iii, pp. 93–94), publishing extended descriptions from specimens collected in Central Illinois and Southern Michigan. It was also briefly mentioned in my paper on the Harvest-spiders of North America in the American Naturalist for October, 1890 (vol. xxiv, p. 916), where it is said to occur in the northern states from New York to Nebraska.

LIFE-HISTORY.

The Ash-gray Harvest-spider passes the winter in the egg state. A few years ago in Illinois I found a bunch of about a dozen small, white, spherical eggs, slightly beneath the soil surface, which were transferred to breeding cages. During the spring they hatched into small, gray phalangids which were

PLATE I.

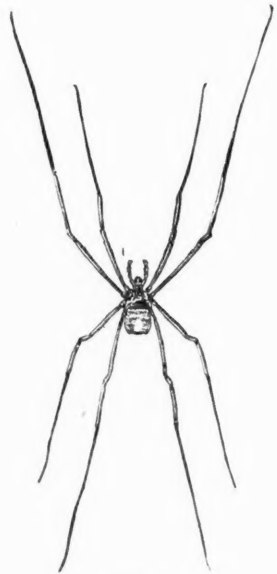
Fig. 1.

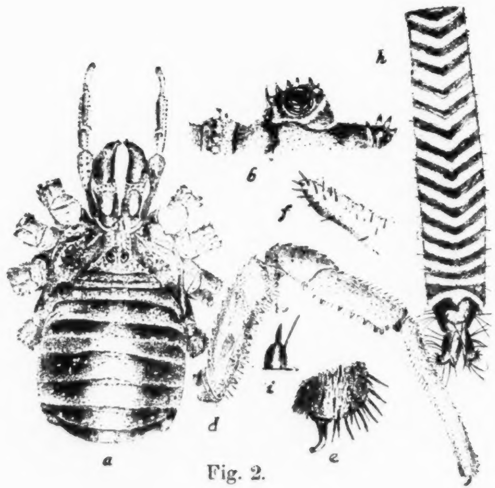

Fig. 2.

Phalangium cinereum Wood.

believed to belong to the present species. I have never seen the female engaged in oviposition, but the structure of the ovipositor (Fig. 2, h) indicates that the eggs are deposited in the ground, about half an inch below the surface. In the latitude of central Ohio there are apparently two broods each season, the first maturing late in June or early in July, and the second, which is much the more numerous in individuals, in September.

This species is preeminently what may be called an in-door species. It abounds especially in sheds, out-houses and neglected board piles, being rarely found, so far as my experience goes, in the open field. Its color especially fits it for crawling over weather-beaten boards, making it inconspicuous against such a back-ground. During the day it is usually quiet, but at dusk, and on cloudy days, it moves about quite rapidly. It probably feeds upon small flies and other insects that it finds during its nocturnal rambles. The only natural enemies that I have seen it suffering from are the web-making spiders, in the webs of which it often perishes, often getting its long legs inextricably entangled.

DESCRIPTION.

The following descriptions have been drawn up from a long series of specimens collected over a wide range of territory.

MALE (Fig. 1; Fig. 2, *a*, *b*, *d*, *e*)—Body, 5–6·8 mm. long; 3–4 mm. wide. Palpi, 4 mm. long. Legs, I, 23–33 mm.; II, 44–52 mm.; III, 24–33 mm.; IV, 31–42 mm.

Dorsum ash-gray, with a slightly darker, sub-obsolete, wide, vase-shaped, central marking; in some specimens entirely obsolete; with transverse series of small spinose tubercles behind the eye-eminence, one row on posterior border of cephalothorax, and one on each abdominal segment except last two, and a curved series in front of eye-eminence. These tubercles (Fig. 2, *h*) have whitish bases, and acute black apices, and also generally have a spinose hair arising on one side near the apex of the white portion, and reaching beyond the tip of the tubercle. In front of the eye eminence there are two longitudinal series of these tubercles of three each. Lateral borders of cephalothorax, subsinuate. Eye-eminence low, canaliculate, with a series of five or six tubercles like those on the dorsum surmounting each eye. Mandibles brownish-white, tips of claws black; second joint and apical portion of first joint furnished with short, black, stiff hairs. Palpi light brown, rather slender, first four joints with minute tubercles and short black hairs: none of the angles prolonged; tarsal joint without tubercles, but with hairs; claw moderately robust. Venter including coxæ, light grayish-brown, with many somewhat quadrangular patches of a more pronounced brown, and scattered blotches of chocolate brown. Trochanters

light brown, with many small tubercles. Remaining joints of legs cinnamon brown, more or less annulated with deeper and lighter shades; angular with longitudinal rows of black spines. Sheath of genital organ subcylindrical, truncate; shaft robust, with two lateral, oval openings near distal extremity, then contracted into a blunt scoop-shaped piece, turned upward at nearly a right angle, and terminating with a slender acute point.

FEMALE (Fig. 2, *g*, *i*).—Body, 6–9 mm. long; 4–5 mm. wide. Palpi 4 mm. long. Legs: I, 21–29 mm.; II, 39–52 mm.; III, 22–29 mm.; IV, 30–37 mm.

Differs from the male as follows: Body larger, rounder. Dorsum darker gray, more mottled; central marking more distinct. Tubercles on dorsum smaller; those on eye-eminence more numerous, and those forming the longitudinal series in front of the eye-eminence also more numerous. Palpi with hairs but without tubercles. Legs with annulations more distinct; trochanters without tubercles; spines on femur less prominent and on tibia obsolete. Narrow quadrangular brown patches on venter of abdomen arranged in transverse series. Distal joints of ovipositor blackish; about thirty in number.

VARIATION.

Like most members of its family the Ash-gray Harvest-spider varies greatly in the size of its body and the length of its legs. To determine the extent of this variation, I collected at Columbus, Ohio, about the middle of September, 1889, a large number of adult specimens of both sexes, which were carefully measured by my assistant, Miss Freda Detmers. The results are shown in the tables on pages 35 and 36.

These tables show a remarkable amount of variation on both sides of the line of average. It will be noted that the difference between the greatest and least measurements averages about one-third the entire length of the latter in both sexes; and that only two cases occur in each table where the leg measurements are identical, viz: Nos. 5 and 13, and 7 and 25 in Table I; and 16 and 20, and 23 and 25 in Table II. These facts indicate how readily this family of long-legged spiders could have been developed from allied forms with shorter legs.

DISTRIBUTION.

Dr. Wood states that this species was found abundantly in northern New York. Specimens in my collection represent the following counties of the states named:

ILLINOIS: Champaign.

IOWA: Story (C. P. Gillette).

MAINE: Penobscot (F. L. Harvey).
MICHIGAN: Ingham (H. E. Weed).
NEBRASKA: Lancaster (Lawrence Bruner).
NEW YORK: Tompkins (J. H. Comstock: N. Banks).
OHIO: Butler, 1 September, 1890; Delaware, 18 September, 1890; Erie, 5 July, 1890; Franklin, 4 October, 1890; 18, 20, 21 September, 1889; 18 October, 1889; Lawrence, July, 1889; Madison, 21 July, 1890.
SOUTH DAKOTA: Brookings (J. M. Aldrich).

Variation of Phalangium cinereum. Table I. Male.

No. of Specimens	Length of Body.	Length of Legs.				Remarks.
		First Pair.	Second Pair.	Third Pair.	Fourth Pair.	
	mm.	mm.	mm.	mm.	mm.	
1		27	49	26	31	Body not meas'd.
2		26	49	27	36	" " "
3		29	51	29	39	" " "
4		31	55	32	40	" " "
5		30	54	30	39	" " "
6		23	44	24	32	" " "
7		29	54	30	39	" " "
8		27	49	27	36	" " "
9		30	54	30	40	" " "
10		26	47	26	35	" " "
11		33	59	33	42	" " "
12		25	46	26	34	" " "
13		30	54	30	39	" " "
14		28	49	27	36	" " "
15		29	54	29	38	" " "
16		32	57	32	41	" " "
17		25	47	25	34	" " "
18		31	55	31	40	" " "
19		29	53	29	40	" " "
20	5·8	28	51	28	36	
21	6·8	31	56	31	41	
22	5·2	27	50	28	37	
23	5·	27	49	28	37	
24	5·4	27	48	27	36	
25	6·2	29	54	30	39	
26	6·	29	55	30	41	
27	5·	27	50	27	37	
Average.	5·6	28	52	29	37	
Shortest.	5·	23	44	24	31	
Longest.	6·8	33	59	33	42	
Difference	1·8	10	11	9	11	

Variation of Phalangium cinereum. Table II. Female.

No. of Specimens	Length of Body.	Length of Legs. First Pair	Second Pair.	Third Pair.	Fourth Pair.	Remarks.
		mm.	mm.	mm.	mm.	
1	5·9	24	44	24	34	
2	7·	23	44	24	34	
3	7·	24	47	25	36	
4	7·2	22	43	24	33	
5	7·4	22	45	23	34	
6	9·4	24	46	25	34	
7		22	42	22	31	Body not meas'd.
8		29	52	29	38	" " "
9		21	43	22	32	" " "
10		25	47	26	35	" " "
11		25	46	25	34	" " "
12		24	47	26	35	" " "
13		22	43	23	32	" " "
14		24	45	25	35	" " "
15		24	48	26	35	" " "
16		22	42	23	32	" " "
17		24	48	25	36	" " "
18		22	41	22	33	" " "
19		23	44	24	34	" " "
20		22	42	23	32	" " "
21		21	39	22	30	" " "
22		26	49	27	37	" " "
23		23	43	23	33	" " "
24		23	40	23	31	" " "
25		23	43	23	33	" " "
Average.	7·3	23	45	24	33	
Shortest.	5·9	21	39	22	30	
Longest.	9·4	29	52	29	37	
Difference	3·5	8	13	7	7	

EXPLANATION OF PLATES.

Fig. 1.—*Phalangium cinereum,* male natural size. (Original F. Detmers, *del.*)

Fig. 2.—*Phalangium cinereum,* structural details: *a,* body of male, back view; *b,* eye eminence of male, side view; *d,* palpus of male, side view; *e,* claw of palpus of male, side view; *f,* maxillary lobe of second legs, of female; *h,* apical joints of ovipositor; *i,* dorsal tubercle of male—all magnified. (Original, F. Detmers, *del.*)

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DEPERET, M., et F. LEENHARDT.—Note sur la Dècoverte de l'Horizon du Montaignel, a Bulimus hopei dans le Bassin d'Apt. Extrait de la *Bull. Carte Geol. de la France*, No. 16, Tome II. From the authors.

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RECENT LITERATURE.

Report of the U. S. Fish Commission for 1887.—This report is an illustration of the delays experienced by those having work to be done by the Government printing office in Washington. Were it not for the circulation of separate copies in advance, the scientific part of the report might be anticipated several times. Now that it is here, we can congratulate Hon. Commissioner MacDonald, on the value of the work. An account of the fisheries of Lakes Erie, Huron and Michigan comes first. It is illustrated by several excellent cuts of important food fisheries. Descriptions of the Albatross and Grampus vessels of the commission follow, with itineraries of their latest voyages. These are admirably illustrated. Then follows a monograph of the species of Labridæ of the seas of the Western Hemisphere, by Prof. D. S. Jordan, which is of the most thorough character, without going beyond the usual systematic features. It is illustrated by numerous excellent figures. The last essay is a long one by Prof. Linton,

on Plathelminthic Entozoa observed by him in various species of North American fishes. Many remarkable forms are described among which are many novelties, not a few of which are referred to new genera. We give some of the illustrations from the Report, through the kindness of Col. MacDonald.

A Catalogue of the Birds of Indiana.—By Amos W. Butler. This excellent catalogue of Indiana birds by this well-known student of the vertebrate fauna of that State is a welcome addition to the Natural History of the region discussed. In this publication is presented in condensed form the results of the author's observations covering the greater part of fourteen years. For a number of years these observations have been conducted as curator of Ornithology of the Indiana Academy of Science. In addition Mr. Butler has had the earnest co-operation of almost every naturalist in the State or who has studied within the State, prominent among whom may be mentioned Prof. J. A. Allen, Mr. Robert Ridgway, Dr. C. Hart Merriam, Prof. B. W. Evermann, Mr. Ruthven Deane, Mr. W. K. Coale, Dr. F. W. Langdon, Mr. E. R. Quick and a number of others, each of whom is duly credited for his contributions. This catalogue has been published in the Proceedings of the Indiana Horticultural Society for 1890, and the Society is to be congratulated upon its success in presenting so pleasing a publication. The list enumerates 305 species which have actually been found in Indiana, and gives a "Hypothetical list" of 79 species "which have been taken in neighboring States or whose known range seems to include Indiana." The care exhibited in the preparation of these lists is notable and considering the condensed form of the publication, the annotations are good and give much new information concerning the birds of the state. Following the introduction (which contains a brief account of the topography of the State, and a copy of the law "for the protection of Birds" passed by the last state legislature) is a "Bibliography of Indiana Ornithology." Next is given the Catalogue which is illustrated by numerous cuts from Coues's "Key to North American Birds," then the hypothetical list, followed by a list of the persons who have assisted by contributions in the preparation of the Catalogue. In conclusion is a carefully prepared index to the whole work. One can but wish that all publications of this kind were as convenient as this one, and that all of our States had a catalogue of their birds so well presented.

General Notes.

GEOGRAPHY AND TRAVELS.

At the meeting of the Society of American Naturalists, held in Philadelphia, Dec. 30, 1891, reports from four exploring expeditions were read. The following abstracts of them appeared in the Philadelphia *Ledger* soon after:

The Galapagos Islands.

Prof. George Baur, of Clark University, Worcester, Mass., presented his report on his expedition to the Galapagos Islands, in the South Pacific Ocean.

The expedition left New York May 1, on the steamship City of Para, most of the funds for which having been provided by Mr. Stephen Salsbury, one of the trustees of Clark University, a contribution from the Elizabeth Thompson Fund of Boston, Prof. H. F. Osborn and others.

The expedition reached Chatham Island, one of the group, on June 9th. Here they remained over two weeks, during which extensive collections were made. Great differences were noted in the climate between the upper and lower portion of the island. In the former it was nearly always damp, rain falling nearly every night and day; while, in the latter, it was very agreeable, and rain seldom fell.

On the 27th of June the expedition left Chatham Island, and reached Charles Island the next day.

Before going on the expedition, Prof. G. Baur had announced the conclusion that the Galapagos Islands were, contrary to the general opinion, to be considered as continental; that they developed through subsidence, and not through elevation by volcanic activity. This conclusion led him to the establishment of the two following theses:

First. Continental islands must have a harmonic distribution of fauna and flora.

Second. Oceanic islands must have a disharmonic distribution.

From all that is known about the Galapagos Islands, it appears that the distribution was harmonic.

Charles Island was the first taken for comparison, and here everything seemed quite different from Chatham. The hills were more rounded, and there was very little indication of more recent volcanic eruption. The rocks were more decomposed, but more dry than Chatham. The composition and aspect of the flora were different. Many of the large trees of the upper region of Chatham were totally absent.

The composition of the fauna was also different. As in Chatham, the members of the expedition made large collections on Charles Island, and, as on that island, the birds were very tame, especially the small birds.

"Very often," said the Professor in his report, "the small birds alighted on my hat or gun when I kept quiet."

As an illustration of how tame the birds were, Prof. Baur related the following:

"I was watching a lizard, when a species of *Buteo*, alighted on a little bush about three feet from me. I had with me a small switch, and began to tickle him over the head, neck and body. This he seemed to like very much, not showing any fear whatever. After this I went to a small island a few yards away from the spot. I had hardly arrived there when the bird came over, alighted near me and allowed itself to be tickled again."

The birds are restricted to the single islands, and on each of them are but few species of a genus, and the land-birds at least never seem to travel from one island to another.

"Tortoises were extinct on Charles Island long ago. They are also extinct on Chatham, Barrington, Hood, and Jeans, on which islands they formerly existed. No tortoises were ever found on Tower and Brindloe.

"On South Albemarle, where we remained nearly three weeks, we secured quite a number of specimens. Here the tortoise is still numerous.

"The large and high islands of the group show the richest flora. In the flora were found the same differentiation on the different islands as in the fauna, so far as could be observed."

The report concluded about as follows:

"There cannot be any further doubt that the distribution of the flora and fauna of the Galapagos Islands is absolutely harmonious. It is this harmony in the distribution which has led me to the theory that the islands are continental and not oceanic. How could we explain by the theory of elevation, now generally accepted, harmonious distribution? It is simply an impossibility to give any explanation on this theory. The theory of subsidence, however, makes every point clear at once. All islands were connected together at a former period. At this time the number of species must have been small. Through isolation into single islands, the peculiar specialization of the species which we found began—an originally single species was differentiated in many

different forms. Every, or nearly every, island developed its peculiar races.

"Now, after it has been shown that the Galapagos Islands are continental islands, the question arises, How about other continental groups which are generally considered to-day of oceanic origin? How about the Sandwich Islands and the others in the Pacific Ocean? And how about the theory of the constancy of the ocean basins? Is this theory on a sound basis? I do not think so; and I am glad to say that this theory has been doubted recently by eminent geologists.

"But geology seems to be unable to give a definite answer. Here biology came to help by a detailed study of the organisms of the different groups of islands and their geographical distribution. I think it will nearly always be possible to determine whether the groups have originated through subsidence or through elevation. In the first case we will find harmony; in the second case, disharmony.

North Greenland Expedition.

Prof. Heilprin followed with a report of the expedition sent out last June by the Academy of Natural Sciences to Greenland. He reviewed the journey from Disco to McCormack Bay, where Lieutenant Peary and his party were left. He described the town of Godhavn, and gave a vivid word-picture of the bleak coast of Greenland. He told minutely the story of the struggle with the ice-pack in Melville Bay, and described the appearance of the great ice sheets and of the huge icebergs met with. He also gave a sketch of the place where Lieutenant Peary built his headquarters, and what he expected to accomplish. Prof. Heilprin also reported briefly on the valuable collections made, and of the otherwise successful results of the expedition.

Labrador's Fauna and Flora.

Prof. L. A. Lee, of Bowdoin College, Brunswick, Me., made a report on the scientific expedition to Labrador last summer, under the title of "Scientific Results of the Bowdoin College Expedition to Labrador." The party consisted of nineteen persons, mostly graduates of the College, and left Rockland Me., on the 27th of last June, returning September 24. Most of the time was spent on the coast of Labrador, between the Straits of Belle Isle and Hopedale, Latitude 55° 27′ North. Much dredging was done along the coast, which brought to light abundant species of molluscs and crustacea, many of them new to the known fauna of the country.

In the mouth of Hamilton Inlet a true deep-sea deposit was found in fifty fathoms of water, where the bottom consisted largely of the

shells of arenaceous Foramenifera, like *Hyperammina.* The number of known species of fish was doubled, and specimens were secured of a remarkable deep-sea *Plagyodus.* In archæology a very interesting discovery was made of the remains of an ancient Esquimaux village, among the refuse of which were found many bone implements, ornaments and carvings of ivory.

The work of a sub-expedition, which rediscovered the grand falls, whose height was shown to be 316 feet, was briefly referred to. In closing, Prof. Lee said that, while a great many additions to the fauna have been made by the large collections secured, there is still great opportunity for further investigation and exploration, and the members of the expedition consider the country a very important field.

Studies of the Gulf Stream.

The last report presented to the meeting was by Prof. William Libbey, Jr., of Princeton University, and it proved one of the most interesting and valuable of the series. It referred to the study, with the United States Fish Commission, of the currents in the Gulf Stream on portions of the Atlantic coast. The Professor said the work was conducted on a series of lines parallel to the coast of New Jersey, between Block Island and Nantucket. Along these lines, which were 150 miles in length, were made a series of stations, at which stations observations were made in temperature and densities; also in currents; and, at the same time, meteorological observations. All of these observations, he said, showed the peculiar relations of the Gulf Stream to the Labrador current. The position of the different curves of temperature were drawn after these observations were plotted. These curves of fifty degrees showed marks of the boundary of the intrusion of the Labrador current into the northern edge of the warmer waters.

Then the fact was shown, continued Professor Libbey, that we were dealing with two different sets of currents—one a deep series, and the other a surface set; both being modified by the mechanical laws of their motion, by changes in velocity, temperature and density. But the surface currents were further modified by the direction, duration and velocity of the wind currents.

The appearance of smaller, band-like currents upon the north-bound Gulf Stream, which were reversed in the direction of their motion after they had passed somewhat to the northward, was explained and offered as a reason for the appearance of schools of fishes at different points of the coast, since the warmer waters provide the proper conditions

for the growth and distribution of the fishes' food, by the bridging over of the cold current.

The effect of the wind on the modification of the northern boundary of the Gulf Stream was pointed out, and it was shown that it had been moving towards the New Jersey coast at the rate of sixty miles per year. The pilot charts of the North Atlantic coast, in which were given the direction and velocities for the last three years, were exhibited to support this view. Further, the influence of these changes in the conditions in temperature and moisture upon our climate were pointed out and some explanations offered.

GEOLOGY AND PALEONTOLOGY.

The Earthquake in Japan.—In a recent letter to the New York *Tribune*, Mr. Kairiyama, a Japanese resident of New York, states he has received letters from Japan containing many particulars of the terrible earthquake in that country, which took place October 28. The section chiefly afflicted was the great island of Hondo, which is the main island of the Japanese empire, embracing many provinces. The surface of the ground at the time of the disturbance was terribly shaken. No person could stand. Houses were instantly thrown down; fire instantly raged, roasting the imprisoned victims. The shocks took place at intervals during four days, and varied from 100 to 600 in different localities. Relief funds are being subscribed in this and other countries.

The London *Daily Graphic* says: "Twenty-six thousand five hundred people were killed and wounded; 90,000 houses destroyed; 200,000 people homeless. Not even the distance between them and us, which robs the facts of so much of their import, the figures of so much of their meaning, can deprive them of all. There are people starving, too; and this is a tangible ill, which we may attempt to lessen as well as to appreciate. An appeal has been made by the Japanese people to our charity. The disaster which has overtaken them is not within human power to foresee or to prevent; but some of the consequences it is only human to attempt to alleviate."

The steamer China, which recently arrived at San Francisco from Hong Kong and Yokohama, reports that, while the steamer was between Hong Kong and Yokohama on the return trip to San Francisco, an imposing sight was witnessed by the passengers and crew.

The great earthquake at Yokohama had taken place a short time previous, and many of the islands in the Yellow Sea were in a state

of volcanic disturbance. About seven o'clock on the evening of Nov. 3d, the China was passing the Aleutian Islands, in Van Diemen's Straits, when, suddenly, the island of Suson seemed all ablaze, and flames and lava shot up a distance of 800 feet into the air.

The steamer was twelve miles distant, and the spectacle, as seen from her decks, was grand. The night was dark, and the eruptions from the crater of the volcano took place at intervals of about fifty seconds. They were accompanied by detonations, which, in the distance, sounded like bombs exploding, and, after each discharge of molten lava and flames, the burning fragments descended like sparks from a gigantic Roman candle.

The American bark Hesper, also lately arrived at San Francisco from Kobe, Japan, after an excellent passage of twenty-seven days, reports a graphic account of an experience with a submarine volcano, hot sea-water and sulphurous gases.

Capt. Sodergren states that, about 6.30 A. M., on October 28, while lying at anchor in Kobe, the bark received a sudden shock that caused the masts to strain and crack. Some of the standing rigging snapped like a piece of twine, and all hands were thrown from their feet. The vessel pitched heavily, and caused one of the cross-trees to break from its fastenings and fall on deck. The waters became still an hour later, and the bark put to sea.

Early on the morning of October 30, when about seventy-five miles off the Japan coast, the bark was almost thrown on her beam ends by the sudden eruption of a submarine volcano. The water became so hot that, when a sea was shipped on deck, the crew took to the rigging. The heat became so intense that the pitch in the deck was melted and the seams opened.

"Great blasts of hot air, with a strong sulphurous smell," said the captain, "would come up from the breaking surface of the ocean and almost suffocate us for the moment. Then the membrane of the nostrils became irritable, causing us all to have a fit of sneezing. This phenomenon lasted for several hours. I have had all I want of the Japan side for some time to come."

Prof. Horace Briggs, of Buffalo, who was in Japan at the time of the earthquake, says immense crevices, from which hot mud and steam escaped, were to be seen in all directions.—*Scientific American*, Dec. 19, 1891.

The Report of the Minnesota Natural History Survey for 1889,[1] an 8vo. of 234 pages, has, for its contents: Summary Statement

[1] The Geological and Natural History Survey of Minnesota. Eighteenth annual report for the year 1889. N. H. Winchell, State Geologist.

for 1889; Report of Field Observations made in 1888, in 1889, N. H. Winchell; American Opinion on the Older Rocks, A. Winchell; Additions to the Library of the Survey since 1884; List of Publications of the Survey.

This report gives an idea of the progress that is being made in the intricate geology in the northeastern part of the State, and of the economic resources that are being developed there. Mr. N. H. Winchell's field observations confirm the views set forth by Irving, Bonney and Lawson, and the conclusions published by the Minnesota Survey, to the effect that the Huronian System, as now defined and understood by the Canadian geological reports, really embraces two or three formations; that one of them is the true Huronian of Murray; another is the Kewatin of Dr. A. C. Lawson, containing the iron-ores at Tower, Minn.; and another is the series of crystalline schists which Dr. Winchell calls the Vermilion series. They are distinctly separated by lithology and unconformities that have been noted from Vermont to Minnesota, and can no longer be included under a single term.

Report of the Geological Survey of Texas, 1889.[1]—The first annual report of the Geological Survey of Texas is presented in 8vo. form of 410 pages, with maps, sections and plates. The general reports of the State geologist and the several field geologists is followed by important papers on the economic geology of the State. Mr. Penrose reports on the iron ores of Eastern Texas, which necessarily includes an account of the general geology of the Gulf Tertiary. Mr. Hill discusses the economic uses of the Cretaceous rocks. Messrs. Cummins and Tarr are studying the problems of the coal, the gypsum and the salt, which are found in the Carboniferous period, and contribute papers on these subjects. Mr. Von Streeruwitz gives a preliminary statement of the geology of Trans-Pecos Texas, with reference to mining interests, and Mr. Comstock a preliminary report on the central mineral region of Texas. Both of these papers contain valuable information concerning the older rocks of the State.

Infusorial Earths of Pacific Coast.—In a recent paper (*Am. Journ. Sci.*, Nov., 1891), Mr. A. M. Edwards has described seven new fluviatile, fossiliferous deposits from Oregon, California and Washington, four of which are from the western side of the mountains, one from the gap, and one from the east; proving that the fresh-water

[1] First Annual Report of the Geological Survey of Texas, 1889. E. T. Dumble, State Geologist.

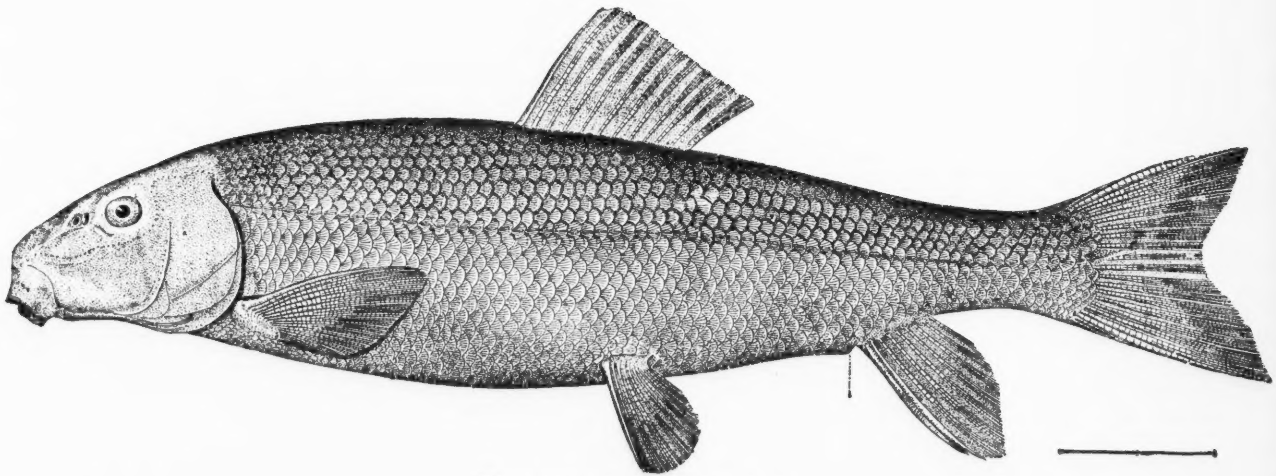
deposits are not confined to the eastern slope, as Bailey had supposed. Mr. Edwards further states that the geological age of a fresh-water Diatomaceous strata cannot be determined by means of the microscope unless they are proved by other evidence to be of greater age than the present period. Enough is known of the habitat of certain species to make it easy to tell whether the deposit has been made in pond, lake, river, marsh, bay or ocean.

On the Relationship of the Plistocene to the Pre-plistocene Formations of the Mississippi Basin South of the Limit of Glaciation.—In the *American Journal of Science,* May, 1891, is published a paper, the joint production of Mr. T. C. Chamberlin and Mr. R. D. Salisbury, on the relationship of the Loess and the Orange Sand south of the limit of glaciation. The deposits investigated by the writers are included between the parallels of 35° and that of the northern limit of the Mississippi Basin. Throughout much of this territory the loess lies upon the glacial drift. It may be traced across the limit of the drift from north to south. The continuity is complete, and the character of the formation is the same on both sides of the line which marks the limit of ice advance. North of the limit, the evidence, in the judgment of the writers, is conclusive that the loess belongs to the closing stages of the first glacial epoch. If, therefore, the age of the loess which covers the drift be first glacial, the age of that which lies south of the drift, in the area under discussion, is likewise first glacial.

Between the relationship of the till north of the limit of glaciation and the relationship of the loess to the residuary earths of the Paleozoic rocks immediately outside the drift there is an important difference. The presence of a weathered and highly-oxidized zone, subjacent to the loess, south of the drift-limit, is as conspicuous as its absence to the north. This oxidized zone is the upper surface of the residuary earths, and clearly indicates the existence of a long interval between the loess and the residuary earths beneath.

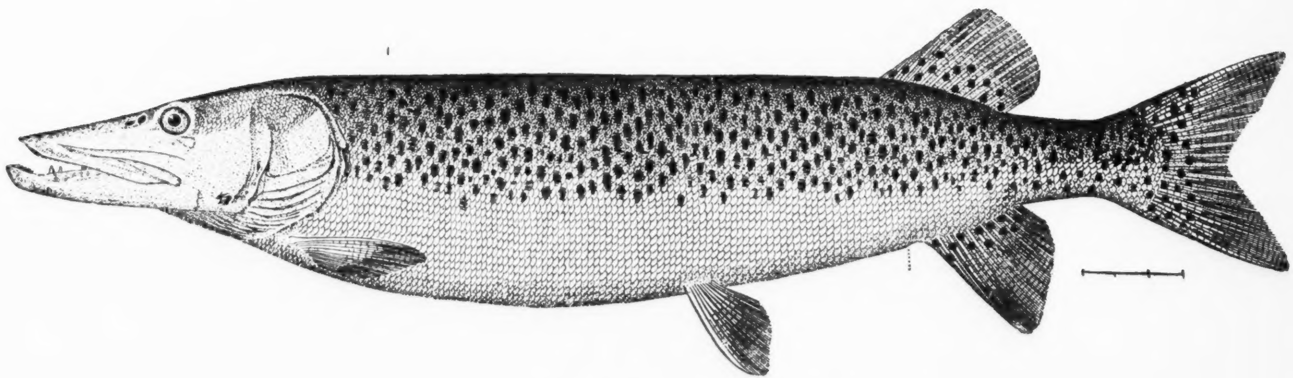
Beneath the loess, south of the limit of glaciation, lie the series of gravels and sands known as the Orange sands. It is a peculiarity of the distribution of loess, that elevations within the area of its occurrence seem to be no obstacle to its presence. The same may be said of the gravel. From their relative position it is evident that the latter is the older of the two. That it is much older is shown (1) by a zone of oxidation between the loess and the Orange sand; (2) by a marked unconformity when the loess covers a hill, indicating a long period of

PLATE II.



Myxostoma macrolepidotum Les.

PLATE III.



Esox nobilior Thomps.

pre-loessial erosion; (3) by chemical changes in the sands and gravels, due to long exposure to atmospheric agencies.

Further evidence is adduced to show that the Orange Sands cannot be referred to the first episode of the glacial epoch, nor to the interval between the two glaciations of the first glacial epoch—they are undoubtedly pre-plistocene; and the conclusion is given as follows:

"In the light of the foregoing evidence, we find but one conclusion possible respecting the age of the Orange Sand. In six States, at least, it is true that, beneath the loess and above the Orange Sand, there is an old surface so deeply weathered and oxidized as to indicate a long period of exposure before the deposition of the loess. . . . . Everywhere below this horizon there is an absence of material which can be referred to a glacial origin; while, above this horizon, the loess and other fluvial deposits contain material of glacial derivation. *This old surface we hold to be the dividing plane between the Plistocene and the Pre-plistocene formations.*"

Cretaceous Fossils from Syria.—A bulletin of the American Museum of Natural History, issued December, 1891, contains observations on some Cretaceous Fossils from the Beyrut district of Syria, in the collection of the Museum, with descriptions of some new species by R. P. Whitfield. A tabulated list shows that, of the 175 species, 93 are Lamellibranchiates and 82 are Gastropods, from six distinct beds of Cretaceous rocks, the lowest of which is above the zone of the *Cidarites glandarius* Lang., below which comes the Jurassic beds of Mejdel el Shems.

The Age of the Staked Plain of Texas.—Mr. R. T. Hill has stated that the superficial beds of this large area (10,000 square miles) are of Cenozoic age. Mr. W. T. Cummins states (First Annual Report of the Geological Survey of Texas) that they are of light-colored calcareous material, and he calls them the Blanco Canyon beds. Dr. E. T. Dumble, director of the Geological Survey of Texas, having sent me some vertebrate fossils from Blanco Canyon, I have determined them as follows: A new species of Equus (*E. simplicidens* Cope) is associated with a Mastodon with molar teeth of the *M. angustidens* type, and a new species of land tortoise, *Testudo turgida* Cope. The association of the genus Equus with the Mastodon of the angustidens type has not been observed previously on this continent, the latter ceasing with the Loup Fork beds, and the former commencing with the Equus bed. The Blanco formation may thus be regarded as

between the two in age, and as filling a gap in the geologic series hitherto vacant.—E. D. COPE.

Boulder Trains and Boulder Belts.—Mr. T. C. Chamberlain recognizes two leading types of glacial boulders: (1) boulder trains, and (2) boulder belts. Boulder trains originate from knobs or prominences of rock which lay in the path of the glacial movement. They lie in the line of glacial movement, but not strictly parallel to it, but rather in radiating lines, and may be called boulder fans. The boulders are usually of a single kind, growing smaller and more worn as traced away from the parent knob, and are mingled with the underlying drift. The boulder belts lie transverse to the direction of glacial movement, are composed of stones of different kinds, from distant sources, and do not mingle deeply with the underlying drift. These boulder belts coincide closely with terminal moraines, which suggests that they were deposited by the margin of the ice that formed the moraines.—*Bull. Geol. Soc. Am.*, Vol. I., 1889.

Geological News.—General.—Elk Lake, discovered by Mr. Chambers, July 6, 1872, is officialy announced as the ultimate source of the Mississippi River.—*Am. Geol.*, Nov., 1891) —— According to J. C. Branner, Crowley's Ridge, in Eastern Arkansas, is not an upheaval, but is the result of an erosion along both sides of it. The ridge is capped with Tertiary, while the valleys, both east and west, are covered with material of a later date. (Report Geol. Surv. Ark., 1889.)——Mr. Ellsworth Call's studies of the geology of Eastern Arkansas have shown that divisions within this area must be based upon stratigraphic and petrographic, rather than upon paleontologic data. The paucity of fossil remains to preclude a classification based upon faunal contents. (Report Ark. Geol. Surv., 1889.)

Paleozoic.—Mr. G. F. Matthew is of the opinion that more than one horizon of life is represented in the assemblage of forms known as the Olenellus Fauna. This appears to be indicated by the fauna of Washington County, N. Y., the source of the Emmons types, which has been recently studied by Mr. Walcott. (*Am. Geol.*, Nov., 1891. ——A series of papers on the Paleontology of the Ohio Valley, by J. F. James, is being published in the *Journal of the Cin. Soc. Nat. Hist.*, 1891. The first one treats of Plantæ and Protozoa. The other groups will be taken up in regular order.——A study of the rocks at Point Pleasant, in Southern Ohio, leads Mr. James to the conclusion that there is no more reason for assigning them to the Trenton than there

would be in making a similar disposition of the lowest beds at Cincinnati. This is contrary to opinions hitherto held, as they have been generally referred to the Trenton. Mr. James considers them part of the series known as the Cincinnati group of Meek and Worthen, for which Walcott has proposed the name Cincinnati Shale and Limestone in the Hudson Terrane. Mr. James remarks, in this connection, that there is no good reason to say that the Trenton outcrops at the surface in any locality within the borders of Ohio. (*Journ. Cin. Soc. Nat. Hist.*, July, 1891.)

Mesozoic.—M. Philippe Thomas reports valuable deposits of phosphate of lime in the cretaceous marls of Tunis. The most important are located in the southwestern part of the high plateaus. (*Rev. Sci.*, Nov., 1891.)——The left ramus of a mandible of *Homoeosaurus major* was exhibited by Mr. Boulenger at a recent meeting of the London Zool. Soc. The specimen was taken from the Forest Marble in Wiltshire. (Proceed. London Zool. Soc., Feb., 1891.)——A recent paper by Mr. Lydekker, on *Ichthyosaurus tenuirostris* concludes as follows: "It appears from the recent researches of Dr. E. Fraas that the type of *I. acutirostris* Owen has smooth, carinated teeth like those of *I. platydon*, so that this species should be transferred to the Platyodont group, which it has been proposed to raise to generic rank as Temnodontosaurus. This leaves the name *I. quadriscissus* as the one best applicable to the other specimens catalogued as *I. acutirostris.* Moreover, Dr. Fraas considers that *I. zetlandicus* Seeley is identical with quadriscissus; and we are disposed to doubt the right of separating *I. longirostris* Jäger (non Owen) from the same. Finally, we observe with satisfaction that Dr. Fraas is disposed to consider the American *Baptanodon* as inseparable from *Opthalmosaurus* of the English Oxford and Kimmeridge Clays, of which such a fine series has been recently acquired by the British museum." (Geol. Mag., July, 1891.)

Cenozoic.—Mr. Crawford has collected a series of facts which indicate that at least two or three mountain ranges in Nicaragua were deeply covered by ice during a glacial epoch contemporaneous with that which existed in the North American continent. (Am. Geol. Nov., 1891.)—According to R. E. Call the silicified woods of Eastern Arkansas are all of Tertiary age. They are silicified lignite, derived from the beds of Eocene clays that underlie the sands and gravels in which they commonly occur. (Am. Jour. Sci., Nov., 1891.) T. M. Boulanger has described a new extinct turtle (*Testudo microtympanum*),

probably from Mauritius. Its principal distinctive features are the very small tympanic cavity and the backward prolongation of the palatines and vomers, the latter forming a suture with the basisphenoid. (Proceeds. Lond. Zool. Soc., Jan., 1891.)——Two species of Procoptodon are described and figured by Mr. Lydekker in the Quarterly Journal of the Geological Society, Nov., 1891. These fossils are two mandibular rami, and they were obtained from the clay-beds near Miall Creek, on the Northern frontier of New South Wales. They have been referred provisionally to *P. rapha* and *P. goliah.*

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The eruptive rocks of Velay, Haute Loire, France, in the order of their age are basalts, trachytes and trachytic phonolites, augite andesites, porphyritic basalts, nepheline phonolites and nepheline basalts. Termier,[2] who describes them, gives but a few brief notes on each type. The younger phonolites form the larger part of the hill. They contain aegerine in light-green porphyritic crystals, and in microlites. At the south-east of St. Pierre-Eynac are tertiary clay slates cut by dykes of phonolite, whose tiny veins penetrate metamorphosed phases of the clastics, and are thus consequently regarded as the agents producing the alteration. The rocks representing the first stage in the alteration consist of granitic debris, in which secondary opal has been deposited around the feldspar and quartz fragments. In some instances, in addition to the opal there have been formed also secondary quartz and calcite, the former as a fibrous rim around the grains. In more intensely changed phases, the slate is traversed by veins of phonolite, whose contact with the sedimentary rock is not visible, since on both sides of it the material of the phonolite has thoroughly impregnated the slate. On the other hand the phonolite of the veins contains sphene, but no augite, while the normal rock contains an abundance of aegerine, but no sphene. In the final stage all the quartz of the slate has disappeared, and the rock is comprised principally of opal, serpentine and clay (halloysite ?), with pleonaste, colorless augite and hornblende as new products. The alteration is thus a silicification. In other, more rare cases, it is a feldspathization.—Hutchings[3] has recently studied the material of which slates are formed, having examined for this purpose, clays and micaceous sand-

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bull. d. Serv. d. l. carte Geol. d. Fr. No. 13, 1890.

[3] Geological Magazine VII, 1890, p. 264 and 316, and Ib. 1891, p. 164.

stones from near Seaton, England, north of Newcastle-on-Tyne. The harder shale layers are composed mainly of mica, quartz, feldspar, zircon and other accessory minerals, as garnet, rutile, anatase, tourmaline, sphene and barite. The biotite is the first of these to undergo change under the influence of weathering processes. In the case studied it has not changed to chlorite, but has become bleached and has yielded epidote. The quartz and feldspar are uniformly distributed throughout the mass, while the mica usually lies out its flat surfaces in the bedding planes. In addition to the mineral grains already mentioned there is present a sort of groundmass or paste, made up of indistinctly granular matter, with microlites of various kinds and a large amount of a fine micaceous substance, besides large plates of a secondary mica. In a fine grained portion of the deposit, the paste is quite abundant and in it are numbers of minute rutile needles, flakes of ilmenite, some small perfect crystals of tourmaline and a considerable quantity of the secondary mica (muscovite), which differs from the clastic mica in that the edges of the grains extend out between the surrounding minerals, and the plates are full of minute rutile needles. In the very finest grained, smoothest clay bands of the region, the paste forms the largest part of the mass, while the well marked clastic grains are few in number, the biotite having disappeared entirely. Kaolin was not certainly recognized in even the thinnest sections of fire-clay, the fine grained granular substance of which this clay principally consists, being mainly the paste described above. The abundance of rutile, that is so noticeable a feature of the clays examined, is supposed to have originated upon the decomposition of the biotites, and the muscovite (or sericite), by the alteration of the paste. This mineral gradually increases in quantity, and then under the influence of pressure is so orièntated that a micaceous slate results. The absence of biotite from most slates is thought to be due to the easy decomposability of the substance; and its presence in the sediments from which some slates were formed is thought to be indicated by the large percentage of rutile and epidote in the latter. In his second contribution to the subject the author describes the results of a separation of the components of a fine clay by fractional levigation, and an examination of the separated portions. He concludes from his study that nearly all the muscovite of slates, and all of the rutile bearing variety, is a secondary product, subsequent in origin to the deposition of the material from which the slates were formed.—The iron ores of Sao Paulo, Brazil, are found in two principal districts, the Jacupiranga and the Ipamena. In the first locality the ore, with a violet titaniferous pyroxene, forms a schistose rock, in which perofskite, apatite and a

zeolitized silicate are accessory constituents. As the amount of the ore increases, that of the other constituents decreases, until in some cases an almost pure magnetite results. By weathering the augite gives rise to mica in abundance. In some cases the pyroxene rock is found associated with layers in which magnetite and nepheline are the principal components. This Derby[1] believes to be genetically connected with the ore-bearing rocks, which he calls jacupirangite, and regards as eruptive. Much of the ore of the Ipanema district originally occured with acmite and apatite as segregations in an acmite syenite, which is now highly decomposed, so that the segregations are scattered like boulders over the ground. Fouque[2] has redetermined the minerals of the Santorin rocks and has discovered that his former determinations of some of them were erroneous. In the pumice of Acrotri, Isle of Thera, composed of glass fibres with opal material between, are little transparent crystals whose nature has heretofore been in doubt. A new examination proves them to be alunite. A quantity—separated and analyzed—gave: SO_3=38%, Al_2O_3=37.3%; H_2O=13.3; alkalies=11.4%. The blocks enclosed in the lava of 1866, formerly supposed to consist of wollastinite, *fassiate* and melanite, are now known to contain in addition to these substances anhydrite. The interiors of the nodules are composed almost exclusively of anhydrite, with a little augite and other constituents of the enclosing rock, in which are wollastonite and melanite. —Four small boulders of nephrite from British Columbia have been examined by Harrington.[3] Three were found near Lytton on the Fraser River, and the fourth in the upper part of the Lewes River, near the Alaskan boundary line. The composition of each is as follows:

	SiO_2	AlO_2	FeO	MnO	CaO	MgO	Loss	Sp. Gr.
1.	55.32	2.42	5.35	.52	14.00	20.16	2.16	3.0278
2.	56.98	.18	4.59	.17	12.99	22.38	2.64	3.003
3.	56.54	.40	3.61	.16	13.64	22.77	2.92	3.01
4.	56.96	.51	3.81	.53	13.29	22.41	2.91	3.007

No. 3 contains pale hornblende crystals extinguishing at 8°-18°. —Derby[4] has discovered that xenotime is an almost universal constituent of muscovite granites, and presumably of other acid potash rocks. Residues obtained by washing the powder of such rocks in a gold washer's pan nearly always yields xenotime and monazite. Eighty-six and two-thirds percentage of the undoubted muscovite granites from

[1] Amer. Jour. Sci., Apr. 1891, p. 311.

[2] Bull. Soc. Franc. d Min., 1890, XIII, p. 245.

[3] Trans. Roy. Soc. Can. 1890, p. 61.

[4] Amer. Jour. Sci., Apr., 1891, p. 308.

Brazil, examined by Derby, disclosed the presence of this accessory, which is thought by him to be as constant a constituent of these rocks as any mineral save zircon. Experiments made with granites from the United States seem to indicate the value of the pan as a petrographical instrument in the study of the rare and heavy components of rocks. —The rare blue hornblende riebeckite is reported by Cole[1] in three pebbles found in the drift of North England and of Wales, in addition to its occurrences in the microgranite of Mynydd Mawr, where it was discovered by Harker and Bonney a few years ago.

Mineralogical News.—General.—Since many of the supposed paramorphs have been proven within recent years to be due not to the molecular rearrangement of material already existing, but rather to the solution of some original substance and its replacement by a new deposition, Bauer[2] has re-examined the pseudomorphs of *rutile* after *brookite* from Magnet Cove, Ark., to determine whether or not the substance is a true paramorph. After studying many thin sections of the brookite, rutile, and intergrowths of the two, he concludes that the latter are true paramorphs, the rutile originating in a molecular re-arrangement of the TiO_2. The rutile begins to form on the exterior of the brookite crystals, or along cracks in them, as needles penetrating the brookite substance. The rutile pseudomorphs after anatase from Brazil, the Urals and other[3] localities, are also declared to be true paramorphs. The same author has also re-examined the *Michel-levyite* of Lacroix, which. Dana declared to be barite, and finds that Dana's statement is correct The axial angle is large, but it cannot be measured, as the acute bisectrix does not enter the field of view. The mineral differs from ordinary barite only in the possession of a very perfect cleavage in the direction of one prismatic face. On the base it shows twinning striations resembling those of plagioclase. The twinning plane is the prismatic face parallel to which is the most perfect cleavage. The structural peculiarities of the Perkin's Mill barite are all due to this abnormal cleavage, which in turn is dependent upon the twinning, which is new to the mineral, and is probably the result of pressure. Measurements of druse crystals of the same substance yield the forms characteristic of barite and the new plane $\frac{1}{12}\,P\breve{\infty}$ with $a : b : c = .8152 : 1 : 1.3136$.—The mineral associated with calcite and phillipsite as druses on the leucite,

[1] Miner. Magazine, IX, 1891, p. 222.
[2] Neues. Jahrb. f. Min., etc., 1891, I, p. 217.
[3] Ib. p. 250.

tephrite of Eulenberg in Bohemia, pronounced by Zepharovich[1] to be orthoclase, has been carefully investigated by Gränzer,[2] who thinks it more likely to be a *zeolite*. Its crystalization is probably triclinic, though by the parallel growth of many individuals there is built up a form closely resembling that of orthoclase.—The minerals characterizing the hollow spherulites of the rhyolite of Glade Creek,[3] Wyoming, and of Obsidian Cliff, in the Yellowstone National Park, like those found in other lithophysæ, are thought to be the results of aqueo-igneous fusion upon the material of the acid lava. The most abundant mineral thus formed is *quartz*, whose crystals are either attached to the walls of the cavities, thus exposing only one termination, or are interlaced forming a network built up of crystals occasionally doubly-terminated. Both the rare $+\frac{3}{2}$ R and $-\frac{3}{2}$ R are well developed, and also the equally rare forms $\pm\frac{3}{2}$ $P\frac{3}{2}$. The next most noticeable mineral is *fayalite*, whose habit has already[4] been described. In some of the more irregular cavities at Glade Creek are accumulations of very small *sanidine* crystals, *hornblende* and *biotite*, of which the latter is never found associated with fayalite.—The *rhodizite* from the Urals, which has been declared to be regular with ∞ O and O_2, is pyroelectric. The examination of it, extinction and its interference colors shows it to be pseudosymmetrical it being in reality monoclinic[5] with $a : b : c := .707 : 1 : 1$. $\beta = 90°$. The dodecahedron becomes OP,—P, +P and $\infty P\grave{\infty}$ and the tetrahedron $\pm O_2$ $P\overline{\infty}$ and $\infty P 2'$. An interesting series of experiments made by the same mineralogist on *jeremejewite* lately described by Websky[6] shows it to consist of an interior hexagonal kernel, surrounded by two zones with some orthorhombic properties, and an external one, with the characteristics of the kernel. The density of the material in each zone is the same, and its reaction under pressure and temperature is similarly slight. The kernel and the peripheral zones are uniaxial and negative, while the other two zones are biaxial, the inner one possessing the larger optical angle. The explanation of the phenomena offered by the author is to the effect that in the first stage of the mineral's growth it separated as an orthorhombic substance on the walls of the cavity. Upon this were deposited zones two and three, after which the cavity was filled by what is now the kernel. The optical anomalies of *phacolite*

[1]Sit. d. Kais. Ak. d. Wiss., 1885, X, p. 601.
[2]Min. u. Petrog. Mitth. XI, 1890, p. 277.
[3]Iddings & Penfield: Amer. Jour. Sci., July 1891, p. 39.
[4]Ib. XXX, July 1885, p. 59, and Ib. p. 271.
[5]Klein. Neues. Jahrb. f. Min., etc., 1891, I. p. 77.
[6]Ib. 1884, I, p. 1.

and *chabazite* are ascribed to the same causes as those assigned to the anomalies of analcite.—Some doubt having been cast upon the correctness of Baumhauer's conclusion that *nepheline* is trapezohedrally henihedral, the mineral from three bombs of Vesuvius has again been examined. The figures produced on the ∞ P faces of crystals, upon etching with HCl and H F, are unsymmetrical; consequently their crystalization is either pyramidal or trapezohedral hemihedral, and the forms are hemimorphic with respect to the vertical axis.[1]—Saltman[2] records the following as the composition of a *melanite* from Oberrothwell in the Kaiserstuhl:

SiO_2	TiO_2	ZrO_2	Al_2O_3	Fe_2O_3	Mn_2O_3	FeO	CaO	MgO	Na_2O	K_2O	Loss
30.48	11.01	1.28	3.13	15.21	.28	3.84	30.19	2.28		1.65	.19

It is interesting for the large percentage of titanium shown by it, and for the considerable quantity of zirconium, which has heretofore never been found in any member of the garnet group.—After examining critically more than fifty analyses of *vesuvianite*, Kenngott[3] concludes that the composition of the mineral must be represented by a formula of two parts, like that of apatite. The silicate portion may be represented by $4\ (2\ RO.\ SiO_2) + 2\ R_2O_3, 3\ SiO_2\ [= 4\ R''_2\ SiO_4 + R'''_4\ (SiO_4)_3]$. The composition of the non silicated portion is not yet known, but it probably contains the hydroxide group, sodium, potassium, and sometimes fluorine, in varying proportions.—*Almogen*[4] crystals from the Pic-de-Teyde, Teneriff are tabular in habit. They are negative and crystalize monoclinically with $a : c = 1 : .825.\ \beta = 97°34'$.—Rose colored dodecahedral garnets from Xalostic, Mex., have been analyzed by De Landero.[5] Their density is 3.516 and hardness 7.5. Their composition corresponding to $(Ca\ Mg)_3\ Al\ Fe)_2\ (SiO_4)_3$, is:

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	MnOBaO	Res.
40.64	21.48	1.57	35.38	.75	tr.	.17

—Some good sections of *pericline* from the Pfitschthal, Tyrole, have been very carefully studied by Münzig.[6] Their optical properties indicate that the substance is not a pure albite, but that it is an intergrowth of oligoclase (ab-an) with albite. The former comprehends the larger part of the pericline crystals, the latter appearing in it as small irregular flecks. Both feldspars are twinned according to the pericline law, with the albite apparently occupying pores in the oligoclase.—Des

[1]Baumhauer: Zeits. f. Kryst. XVIII, p. 611.

[2]Ib. p. 628.

[3]Neues. Jahrb. f. Min., etc., 1891, I, p. 200.

[4]Becke: Min. u. Petrog. Mitth., XII, p. 45.

[5]Amer. Jour. Sci., 141, 1891, p. 321.

[6]Neues. Jahrb. f. Min., etc., 1891, II, p. 1.

Cloizeaux[1] notes the similarity in habit between *chalcopyrite* crystals from Cuba and those of the French Creek Mines in Chester Co.,[2] Pa. A comparison of recent analyses of *violan* and *anthochroite* leads Igelström[3] to the conclusion that the two are identical.—In a recent brochure of the American Geological Society, Kunz[4] announces the discovery of small *diamonds* in the alluvial sands of Plum Creek, Pearce, Co., Wis., and the occurrence of fire opal in a vesicular basalt at Whelan, Washington.—Sandberger[5] has found pseudomorphs of markasite after pyrargyrite at Chanarcillo, Chile.

Miscellaneous.—Syntheses.—Lorenz[6] has produced crystallized zinc sulphide by the sublimation of the amorphous salt in an atmosphere of ammonium chloride. The action is explained as taking place in two stages—first, the formation of zinc chloride and its sublimation, and secondly, the action of sulphuretted hydrogen upon this salt. By the action of dry H_2S on the respective metals crystalized *troilite, millerite, wurtzite* and *greenockite* were formed. The first is in little opaque tabular crystals, that are at first silver white and afterwards bronzy-yellow in color. According to Prof. Groth, they are probably hemimorphic. In addition to the greenockite there were produced in the same operation other crystals that are seemingly cadmium sulphide.—Though the synthetical production of augite is not a difficult problem, that of hornblende has heretofore resisted the best efforts of mineralogists to effect it. Chrustschoff[7] has however lately succeeded in obtaining the mineral by heating in a glass tube, from which the air had been extracted, a mixture of dialysed colloidal silicic acid containing 3% of SiO_2, and dialysed solutions of Al_2O_3, $Fe\,(OH)_3$ and $Fe\,(OH)_2$, with lime water, freshly prepared $Mg\,(OH)_2$ suspended in water, and a few drops of sodium and potassium hydroxides. Upon heating these together for about three months at 550° the mixture became of a dirty-brownish-green color, when it was found to contain tiny hard grains of hornblende, analcite quartz, feldspar and diopside. The hornblende crystals were bounded by $\infty P\grave{\infty}$, $P\grave{\infty}$ and ∞P. Their extinction $c \wedge C = 17°50'$. Their

[1]Bull. Soc. Franc. d. Min., XIII, p. 335.
[2]Cf. American Naturalist, 1889, p. 528.
[3]Neues. Jahrb. f. Min., etc., 1890, II, p. 271.
[4]Bull. Geol. Soc. Amer., Vol. 2, p. 638.
[5]Neues. Jahrb. f. Min., etc., 1891, I, p. 199.
[6]Ber. d. Deutsch. Chem. Ges. No. 9, 1891, p. 1501.
[7]Neues. Jahrb. f. Min., etc., 1891, II, p. 86.

double refraction was negative and pleochroism strong. 2 V=82°, and composition:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	Loss
42.35	8.11	7.91	10.11	14.33	13.21	2.18	1.87	.91

—Otto and Kloos[1] find perfect crystals of periclase on a muffel in which magnesium oxychloride has been heated.

General.—The solubility of quite a number of minerals in pure water and in dilute salts has been carefully investigated by Doelter.[2] The sulphides, sulpho-salts, oxides and silicates examined are slightly soluble in water, with the addition of sodium sulphide the solubility of the first two groups is increased while that of the oxides is increased by sodium fluoride. The carbonate of sodium appears to produce but little effect upon these. The silicates are more readily soluble in carbonated water and in dilute solutions of sodium carbonate. Distilled water seems to act simply as a solvent upon all classes, whereas the other reagents produce more or less decomposition. Gold is dissolved to some extent in both the silicate and the carbonate of sodium at high temperatures. —Two instruments for the observation of the optical properties of minerals at high temperatures are described by Klein,[3] and a third by Fuess.[4] One is adapted for use on the microscope, where temperatures not greater than 450° are required. The second allows of observations at a bright red heat, the source of heat being electrical. The third is for use with gas.—Miers[5] gives a description of a simple and cheap, though quite accurate goniometer for student's use. Rinne[6] outlines an easy method of determining the character of the double refraction in uniaxial and biaxial crystals in converged light, based on the use of the gypsum plate. Practically the determination depends largely upon the colors of different segments of the microscopic field. It is especially valuable in determining the sign of weakly doubly refracting substances.—The fifth part of Hintz's Handbuch der Mineralogie[7] concludes the treatment of the mica group, and deals in the usual thorough manner with the chlorite and serpentine groups.

[1]Ber. d. Deutsch. Chem. Gesell, 1891, p. 1488.
[2]Min. u. Petrog. Mitth. XI, 1890, p. 319.
[3]Neues. Jahrb. f. Min., etc., 1890, I, p. 65.
[4]Ib. B. B., VII, p. 406.
[5]Min. Magazine, IX, 43, p. 214.
[6]Neues. Jahrb. f. Min., etc., 1891, I, p. 21.
[7]Leipzig 1891, p. 641-800.

BOTANY.

Notes on The Flora of Western South Dakota.—The following paper was read before the Botanical Seminary of the University of Nebraska by Professor T. A. Williams, of Brookings, S. D.

The region west of the Missouri River may be divided into three quite distinct botanical districts. The Range, The Black Hills, and The Badlands. The first is much the largest, extending from the River on the North and East to The Badlands on the South and the Black Hills on the West. It is a broad stretch of prairie varying from level tableland to rolling prairie or in many places becoming quite rough and broken, especially along the streams which traverse the region at varying intervals. The second region comprises the highlands, cañons and mountains of the Black Hills country. The Badland region begins near the Mouth of Indian Creek on the Cheyenne River and extends southward skirting the Hills, reaching into Nebraska. The strip of country varies from ten to about thirty miles wide. The surface is very broken and the soil dry and sterile, excepting in some of the basins where a little poor water is found giving life to *some* vegetation.

My visit to these regions was made in August of the past year (1891). Not a very good time for collecting so far as the number of specimens is concerned, but nevertheless a time when one can form a fair idea of what the characteristic plants of the regions are.

I shall not soon forget the impressions I received when, as we climbed the bluffs out of the narrow valley of the River at Ft. Pierre, the wide stretch of miles upon miles of dry prairie came to view. As far as the eye could reach nothing could be seen but that peculiar monotonous color of grass dried prematurely. Not a very inviting outlook for a botanist. Along the bluffs of the River we had made several finds and were beginning to hope that we should have a profitable trip, but at the sight of that dreary waste of sunburnt prairie our hopes fell. However our fears proved to be groundless, for as we soon learned things are not always "what they seem." The creeks, which occur here and there throughout the range, are veritable mines for the botanist. Very few of them contain running water at this time of the year. Usually they are nothing more than a chain of ponds, containing from a few inches to a few feet of water. These streams are a continual source of delight to the collector. They are usually separated a con-

siderable distance by a stretch of dry prairie which forms a very effective barrier to an interchange of species, consequently each stream has a few plants that seem to be peculiar to its own territory, and the collector is continually running across new things. There are a few of the larger ponds that do not contain one or more species of *Chara*, *Potamogeton*, or some other of the water loving plants. *Potamogeton hillii*, *P. pectinatus*, and *P. zosteræfolius*, were common. *P. fluitans* was found at Mitchell's Holes, but at no other place; *Sagittaria variabilis* occurred in some of its various varieties throughout the entire region; *Atriptex argentea*, *Xanthium canadense*, *Solanum rostratum*, *Euphorbia marginata*, *Helianthus annuus* and *H. petiolaris* were common all along the trail from Pierre to Rapid City. At Ft. Pierre, Peno Hills, and Willow Springs *Amorpha microphylla* was common along with *A. fruticosa* and *A. canescens*. Our old friend *Saponaria vaccaria* was found at intervals along the entire way to the Black Hills, a good example of man's influence in the introduction and distribution of plants. Does not this give a hint as to how eastern species advance westward? I have noticed similar instances along the old freighting trail in Nebraska, which runs from Nebraska City to Denver. The principal grasses of the range are, *Boutelova oligastachya*, *B. hirsuta* and more rarely *B. racemosa*, *Buchloe dactyloides*, (fast disappearing), *Agropyrum glaucum*, several species of *Calamagrostis*, and *Stipa comata*, the last species replacing the common *S. spartea* of the eastern part of the State. *Agropyrum glaucum* forms by far the greater part of winter as well as the summer feed of the stock of the range.

Spartina cynosuroides, several species of *Glyceria*, *Carex*, and *Scirpus* grow along the streams and form no small part of the food of the stock during the drier seasons of the year.

Oxytropus lambertii was common, many species of *Astragalus* were found in fruit but few in bloom. Plums and cherries were of frequent occurrance along the larger streams. One stream in particular has its banks lined with plum bushes for miles and miles and is called Plum Creek. Many people go thirty or forty miles to get the plums, many of which are very large and toothsome; *Shepherdia argentea* in both red and yellow-fruited forms occurs from the Missouri River to the Black Hills. The fruit of some of the trees of this species is quite palatable. Not far from Plum Creek on a hillside I found *Shrankia uncinata*. The whole hillside was a mass of this plant and I procured some of the finest specimens of it that I have ever seen. While we were camped at Grindstone Buttes I collected my first specimens of *Marsilia vestita*. It grew along the margin of a small pond;

many specimens were found where both of the so-called varieties of this species grew on *one stem,* one part of which grew on the bank and the other in the water. I thought I had made a great find but as I learned later this little plant is very common from the Buttes to the Black Hills, hardly a pond being free from it.

On the summits of the Buttes we found *Dalea aurea* in considerable quantity but nowhere else did it occur.

At Peno Hills, about 70 miles East of the Black Hills we found many old friends and many new ones. Along the stream which rises in these hills were good sized trees of elm, boxelder, ash, (*Fraxinus viridis* and *F. pubescens*), hackberry, willow and the like. Here we also found *Amelanchier alnifolia, Crataegus coccinea, Prunus virginiana P. americana* and *P. pumila.* The fruit of both of the cherries was very fine, while *some* small bushes of sand-cherry were found bearing fruit as large and luscious as that of the ordinary cultivated cherries. On the North slope of one of the hills *Juniperus sabina* var *procumbens* formed dense mats, especially along the small draws that lead down from the hillside. The only willows collected in this region were *Salix longifolia* and *S. cordata* var. *vestita* though I am certain that *S. amygdaloides* will be found also.

There are quite a number of small streams between Pierre and the Cheyenne River that would be as well wooded as is this stream at Peno Hills if they could be protected from prairie fires. We saw many fine groves of elm, ash, boxelder and cottonwood that had been killed by fires after the trees had grown to be two and three feet in diameter. The groves at Peno Hills are protected from the fires by means of the line of dry barren hills along the North and West and have become the pride of the whole region.

At the Cheyenne River we found some interesting things; coming down from the high uplands to the so-called second bottom we found *Psoralea tenuiflora* in abundance, for the first time. It reaches its finest development here, being much larger than I have ever seen it elsewhere. On the bluffs that border the narrow valley grew *Ipomoea leptophylla,* several *Oenotheras, Mentzelia ornata M. nuda, Musenium tenuifolium, Stanleya pinnata* and *Lupinus pusillus* (almost always accompanied by a fungus, probably a Phoma, which was very injurious to it.)

Along the cañons near Smithville the silvery form of the red cedar was quite abundant, offering a marked contrast to the common form. The buffalo berry, in both forms was plentiful everywhere. *Astralagus bisulcatus* and its near relative *A. haydenianus* grew on some of the

bluffs, on the west side of the river. The former was also found on the range and in the Badlands.

On the bottoms, which are very sandy, we found *Astragalus latiflorus* and *A. kentrophyta* in abundance. Also *Dalea alopecuroides, D. laxiflora, Croton texensis, Artemisia canadensis, A. filifolia, Stipa comata, Oryzopsis cuspidatus, Munroa squarrosa, Euphorbia petaloidia* and *E. hexagona.* The principal timber tree of the bottom is *Populus monilifera* while *Shepherdia* makes most of the thickest growth. Elm, ash, boxelder, willow, and hackberry tree occurred, but seldom in any great quantities at this place.

Farther up the river these are more abundant. The cottonwood always predominates however. The trees of this species are seldom so high as those seen in Eastern Dakota or Nebraska, but are of a much more close or bushy growth, due doubtless to the fact that the winds often break out the tops, thus producing more branches.

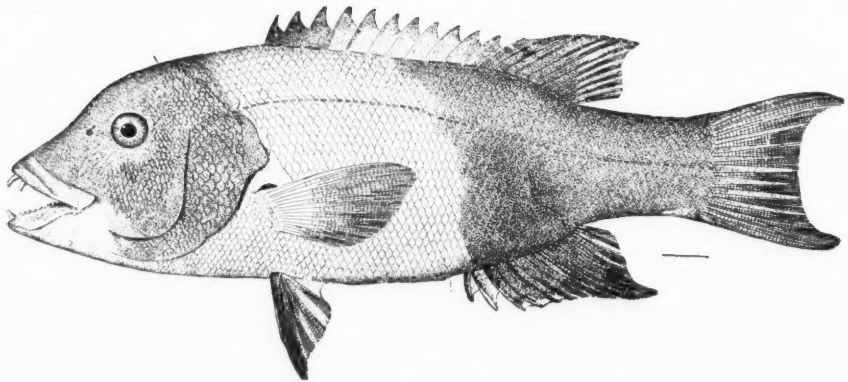
(*Concluded in February Number.*)

ZOOLOGY.

Protozoa.—A number of articles appear every month on the subject of the malaria parasites, treating of their morphology, system and pathogenity. Without going into details of all the original publications, the following may be taken as the most prominent views in regard to the parasites. Laveran, the original discoverer of the parasite which causes malaria, holds fast to the idea that only a single species of Protozoa is concerned in the disease and that the various forms, amoeba, crescent, etc., are only different stages in the development of this parasite (Du Paludisme et de son Hématozoaire, Paris, 280 p. 6 Plates, 1891). Grassi and Feletti on the other hand admit two genera: *Halmamoeba* and *Laverania,* the former with three species: *H. præcox,* producing quotidian fever, *H. vivax,* producing simple or double tertiana and *H. malaria* producing simple, double or triple quartana; Lavarania (the crescent) produces an irregular fever, (Centralblatt f. Bakt. u. Parasitenkunde IX, p. 430, 1891). *Halmamoeba* is supposed to correspond to *Amoeba guttata* and *Laverania* to *A. radiata.* Thus the malaria parasites are classified as Rhizopods by these authors. Metschnikoff, L. Pfeiffer and others class them as *Coccidia,* while Kruse argues that they must belong to the Gregarina, because an adult form is found free in the blood. In comparative Hæmo-parasitology Celli and Sanfelici (Ueber die Parasiten des rothen Blutkörperchen im Menschen und in Thieren, Fortschritte der Medicin Bd. 9, 1891) draw the conclusion that the endoglobular parasitism is more obligatory—and hence more highly developed in the Hæmogregarina of birds than in the blood parasites of cold blooded animals, since in the latter, the parasites thrive in the serum about as well as in the blood corpuscle. According to these authors, the blood parasites of the frog, on arriving at a certain stage, either undergo sporulation, or develop into *Drepanidium* of Ray Lankester.

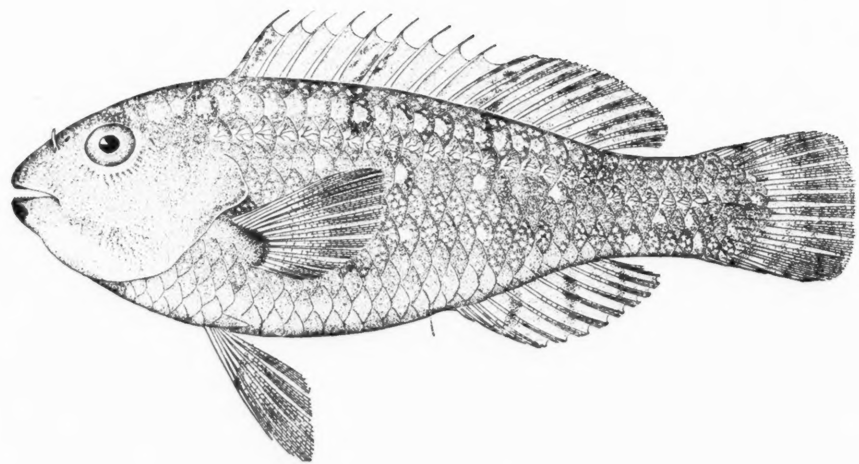
R. Pfeiffer (L. Pfeiffer, Ueber die Pathogene Protozoen) has recently made a very important discovery in regard to the development of *Coccidium.* According to these authors, gymnospores can be developed in the growing Coccidium and serve to spread the infection to other cells. Kruse has come to the same conclusion, but independently from Pfeiffer. Kruse states the gymnospores can be formed at any time during the development of the parasite. These naked spores evidently cannot spread the infection to other animals, this work being left to the other spores (Dauersporen) which are already well-known.

PLATE IV.



Trochocopus pulcher Ayres.

PLATE V.



Scarus hoplomystax Cope

Several authors claim to have found Microsporidia in Vertebrates; not denying their statements as a whole, the reviewer will simply state, that the portion of turtle's flesh given him for comparison, and supposed to be part of Danilewsky's original material, contained no Microsporidia, but was full of minute air bubbles between the muscle-fibres. It seems hardly possible, however, that Danilewsky and L. Pfeiffer could have mistaken these air bubbles for parasites, yet neither Railliet, Balbiani or the reviewer could find any Microsporidia. The material came from L. Pfeiffer.—C. W. STILES.

Trematodes.—Hassall (American Veterinary Review, July 1891) describes the large liver-fluke found in American cattle as *Fasciola carnosa;* as this name is preoccupied he changes the name (Am. Vet. Rew. Sept.) to *F. americana.* [As yet it is impossible to say much in regard to this species. The animal is *undoubtedly* specifically different from *D. hepaticum,* but as I have stated in my Animal Report for 1891, bears very great resemblance to Bassi's *Distomum magnum.* Dr. Hassall and I are at present at work upon this species and hope soon to publish a full account of its anatomy and development.—C. W. S.]

Cestodes.—Dr. V. A. Moore recently presented a case of Echinococcus hydatid in a pig, before the Biological Society of Washington, D. C., and in the discussion which followed, Stiles spoke of two more unpublished cases in animals and one in man. Van Cott, of Brooklyn, has recently given a full account of this last case. It is high time, that the Health authorities in the various cities insist upon burning every organ infected with this hydatid, found in the slaughter-houses, and that more care is used in importing dogs (the final host of this tape worm,) from infected regions, if we wish to avoid an experience such as Australia has had for the past quarter of a century.

Prof. Linton has recently published several valuable papers on the parasites of fish (Notes on the Entozoa of Marine Fishes of New England, I and II; a contribution to the Life History of Dibothrium cordiceps; on two species of larval Dibothria from the Yellowstone Park; all published by the U. S. Fish Commission and free to scientists). These papers will be found to be very valuable in determining the parasites of fish, as the descriptions are very complete. In reading the diagnoses, however, one should remember that Linton unintentionally misused the word "lateral." In places where that word occurs, "dorsal" or "ventral" should be inserted. That Linton simply wrote lateral, by mistake, is proven by the fact that he speaks of the *breadth*

as the "*lateral diameter.*" It is impossible to mention here all of the curious and interesting species Linton has described; in several species of Dibothrium, for instance, the uterus empties *dorsally*, a point about which one would be inclined to be very sceptical, were it not that Linton gives drawings of the animals and exact measurements of the apertures. In one of his papers Prof. Linton determines the white pelican (*Pelecanus erythrorhynchus*) as the final host of *Dibothrium cordiceps* Leidy, the larval stage of which is found in the trout (*Salmo mykiss*) of the Yellowstone Park. The reviewer must differ from Prof. Linton in the interpretation of cysts in which these larvæ are found Linton interpreted them as *blastocysts*, but the histology described by the author gives more the impression that they are connective tissue and since the Reviewer has examined some specimens kindly sent to him by Prof. Linton to determine this question, he does not hesitate to state that we have connective tissue cysts of the host before us, instead of blastocysts. This point is very important, for were it a *blastocyst* as Prof. Linton thought, this species would form an exception in the family Bothriocephalidæ, for the blastocyst would of course be homologous to the cysticercus of Tæniidæ and the head would form in much the same manner. As it is, *not* the cyst, but the enclosed larva, is the homologon of the cysticercus.

The family Taeniidae has been undergoing considerable revision at the hands of the noted French zoologist, R. Blanchard. In a work (112 pp.) entitled Histoire zoologique et medicale des Teniides du genre Hymenolepis, Paris, 1891, Blanchard separates all these tape worms from the genus Tænia, which have three testes in each segment, with genital pores on the left border (for further particulars of the diagnosis, see the original). *Hymenolepis nana* and *H. diminuta* are of particular interest since they occur in man, and *H. murina* (according to Grassi identical with *H. nana*), since Grassi has shown that in this form we have a remarkable exception to the rule of development of the Tæniidae, in that *H. murina* develops *indirectly* but *without change of host.* The following is a synopsis of the species admitted by Blanchard to the genus Hymenolepis. (See Table on pages 67 and 68.)

In his notices Helminthologiques (Mem. de la Soc. Zool. de France, 1891, p. 420-480) Blanchard separates those members of the genus Taenia which have armed suckers into three new genera. 1, *Echinocotyle* R. Bl., '91. Rostellum with 10 large hooks, each sucker with a circle of spines on the edge and a longitudinal row in the middle, etc. 2, *Davainea* R. Bl. and Railliet '91, Rostellum or infundibulum with double row of hooks, each sucker surrounded with several circular rows of hooks. Corpuscles made up of conglomerations of eggs are

Adult Stage.	Host.	Larva.	Secondary Host.
1. H. murina Dujardin,	Mus decumanus	Cercocystis(Grassi)	Same as primary
1845.	M. pumilus		host, villosities of
	M. musculus		the intestine.
	Myoxus quercinus		
2. H. nana von Siebold,	Homo	?	?
1853.			
Syn. Taenia nana v.			
Sieb. (nec. P. J. v. Beneden, 1861.)			
T. aegyptiaca Bilharz., 1852.			
Diplacanthus nanus Weinland, 1858.			
T. (Hymenolepis)			
nana R. Leuckart,			
1863.	Mus musculus	C. tenebrionis	Tenebrio molitor
3. H. microstoma Du-	M. rattus	Villot	
jardin, 1845.	Crocidura aranea	?	?
4. H. furcata Stieda			
1862.	Cr. leucodon	Cercystis(Bl.)Uro-	Silpha laevigata
5. H. uncinata Stieda	Cr. aranea	cystis (v. Lin-	
1862.	Cr. aranea	stow.)	Glomeris limbatus
6. H. scalaris Duj.,		Staphylocystis bil-	
1845.	Cr. aranea	iaris, Villot	Glomeris limbatus
7. H. pistillum Duj.,		St. micracanthus	
1845.	Cr. aranea	Villot	
8. H. tiara Duj., 1845.	Cr. aranea	?	?
9. H. erinacei Gmelin,		?	?
1789.			
Syn. Halysis erinacei Zeder, 1803.			
Taenia tripunctata Braun, 1810.			
T. compacta Rudolphi, 1810.	Talpa europaea		
10. H. bacillaris Goeze,		?	?
1782.			
Taenia bacillaris Dies-			
ing, 1851, proparte.	Vesperugo serotina		
11. H. acuta Rud, 1819.	V. noctula	?	?
Syn. T. obtusata P. v.			
Ben. 1872. nec. Rud.			
1819.	Chilonycteris rubi-		
12. H. decipiens Dies.,	ginosa	?	?
1850.	Molossus perotis		

B Unarmed Hymenolepis, *i. e.* Adult without hooks.

13. H. relicta Zschokke, 1888.	Mus decumanus	Cercocystis	Asopia farinalis
14. H. diminuta Rnd., 1819.	M. decumanus		Anisolabis annulipes
Syn. Taenia diminuta Rud., 1819.	M. rattus		Axis spinosa
T. leptocephala Creplin, 1825.	M. musculus		Scaurus striatus
T. flavopunctata Weinland, 1858.	M. alexandrinus		
T. varesina Erm Parona, 1884.	Homo		
T. minima Grassi, 1886.			

scattered through the parenchym. Most of the species of this group are parasites of birds, *D.* (*Taenia*) *madagascariensis* however is parasitic in man. 3, *Ophryocotyle* Friis, 1869. Rostrum absent, infundibulum present, its border armed with several rows of small hooks. Several transverse rows of hooks on the suckers.

The subfamile Anoplocephalinae R. Bl., '91, contains the unarmed Taeniæ found in herbivorous animals, segments wider than long, egg with pyriform apparatus, 3 genera. 1, *Bertia*, R. Bl., '91, genital pores irregularly alternate, etc., 2 species, found in primate anthropoides, (Mem. cit. p. 186-196). 2, *Moniezia*, R. Bl., '91, two genital pores to each segment, etc., (Bul. cit. p. 444) contains 11 species many of which are important to economic zoology: *M.* (*Taenia*) *expansa* and *M.* (*T.*) *denticulata* of sheep and cattle, etc. 3, *Anoplocephala* Em. Bl., 1868, sexual pores unilateral, etc., contains 2 species: *A.* (*Taenia*) *mamillana* and *A.* (*T.*) *perfoliata* of the horse, etc.

In the same publication R. Blanchard treats more minutely several species of the genus *Moniezia* found in rodents and gives some shorter observations on various Distomes.—C. W. Stiles.

Nematodes.—Willach (Arch. f. w. u. pr. Thierheilkunde, 1891, p. 340-346) describes a new and dangerous parasite, found in nodules of the colon of *Macacus cynomolgus.* This helminth, which receives the name of *Sclerostoma apiostomum*, proved fatal in two out of three cases examined. Stiles (Sur la Dent des Embryons d'Ascaris; Bull. d. l. Soc. Zool. d. France, 1891, p. 162) claims that the so-called "boring tooth" found in embryos of *Ascaris lumbricoides* is composed of three parts, each of which corresponds to a lip of the adult Ascaris.—C. W. S.

Notice of Trematode Parasites in the Crayfish.—Prof. Charles A. Davis, of Alma, Michigan, has submitted to me for identification several cysts from the common crayfish, which prove upon examination to contain immature trematodes. They belong to the genus Distomum and are evidently specifically identical with the specimen described and figured by R. Ramsay Wright in volume XVIII of the AMERICAN NATURALIST, pp. 429—430. Prof. Wright's description is based on a single specimen which he obtained from a cyst in the ovary of a crayfish. He referred it to the species *Distomum nodulosum* Zeder. This species has been found in the cercaria stage in *Paludina impura* by Von Linstow. In the adult stage it is found free in the intestinal canal of several European fresh-water fish (Perca, Esox, Etc.,) and encysted on the outer surface of the intestine of one (*Acerina.*)

The specimens for the most part appear to be a little younger than Prof. Wright's specimens, but the larger ones agree with it in every essential particular. The largest specimen observed, measured, when freed from its capsule and straightened out, 0·1mm. in length. The diameter of the head was 0·4mm. when seen in ventral view. The neck was 0·3mm. in diameter. The body was contracted until it was nearly circular in outline and measured 0·6mm. in breadth. The head bears six papillary appendages. Two of these are lateral, somewhat triangular in shape and project from the anterior edges of the sucker. In the largest specimen observed these measured about 0·2mm. in length. The other four papillæ lie on the antero-dorsal side of the head. They are flattish, bluntly-rounded, 0·1mm. broad and 0·15mm. in length. The oral sucker is considerably larger than the ventral. The former is about 0·3mm. by 0·2mm. in its two diameters, the antero-posterior diameter being the longer. The latter is 0·2mm. in its transverse diameter and a little less than this in its antero-posterior diameter. In another specimen the anterior sucker was 0·36mm. long and 0·3mm. broad, and the ventral 0·2mm. long and 0·24mm. broad. The testes are about 0·2mm. in length. The anterior end of some of the smaller specimens appears to be invaginated.

The cysts are globular. Each specimen when freed from its connective-tissue shell, is found to be enclosed in a thin pellicle. The diameter of the pellicular cysts is, in most cases, about 0·5mm.

Prof. Wright states in the article alluded to above, that the structure of the mouth sucker of his specimen is not entirely in accordance with Von Linstow's description. While my specimens agree so closely with Prof. Wright's that I have no hesitation in regarding them as

identical, I do not find it so easy to refer them to *D. nodulosum*, as described by Von Linstow, Archiv f. Naturg., 1873, XXXIX, where the larval stage from *Paludina impura* and the adult from *Perca fluviatilis* are figured. The same difficulty is experienced when they are compared with Olsson's account, Bidrag till Skand. Helm., pp. 23—24. Taf. IV. fig. 51, where a side view of the head of an adultis figured.

The cysts were found "about the heart, intestine and other organs in the hinder part of the thoracic region." They were collected in December 1891.

It cannot be concluded, from the specimens at hand, that the crayfish is a proper intermediate host of this parasite, although the considerable number of cysts and the different degrees of development of their contents make the inference not altogether improbable that they are genuine guests and not strangers which have strayed into an unusual host.—EDWIN LINTON, *Washington and Jefferson College, Washington, Pa., Dec.* 31, 1891.

Branchiostoma elongatum Sundevall at San Diego, California.—In 1868 Cooper described three specimens of a *Branchiostoma* which he obtained near La Playa in San Diego Bay in 10 fathoms of water. Since then *Branchiostoma* has not again been recorded from the Pacific Coast of America. Last Summer on visiting a dredge which was at work in San Diego Bay near Ballast Point about a hundred specimens were obtained. On subsequent visits to the dredge Mr. L. C. Bragg found them in greater or less abundance.

The specimens were all large, some of them reaching 3¼ in. in length. But very few of them were sexually mature July 1st. Surface skimming never brought the eggs or larvæ. There are about 70 (from 68—75) myocommata arranged as follows: 45 to atrial pore; 16 from atrial pore to anus; 9 behind anus.

The species may be identical with *Branchiostoma elongatum* Sundevall from the coast of Peru, as Dr. Jordan has suggested. The formula differs however, the myocommas in the Peruvian specimens being 49+18+12.

To those engaged in teaching it may be of interest to know that specimens of this Amphioxus may be obtained of Mr. L. C. Bragg, Coronado Beech, California.—C. H. EIGENMANN, *Bloomington, Indiana.*

On the Presence of an Operculum in the Aspredinidæ.—In our "Revision of the South American Nematognathi" (p. 9) we defined the Bunocephalidæ=Aspredinidæ as having no opercle. In this we followed Cope, who separated the Aspredinidæ from the remaining Nematognathi by their lack of an opercle.

We have lately obtained a specimen of *Aspredo aspredo* Linnæus from the Museum of Comparative Zoology and have re-examined this point. The closer inspection has demonstrated the presence of a minute operculum attached to the upper posterior border of the expanded hyomandibular. It is movable in moist preparations but becomes immovably fixed with drying, which may have led to the original statement. The interopercle is about as large as the opercle and apparently immovably joined to the hyomandibular and preopercle. Brühls "Osteologisches aus dem Pariser Pflanzengarten" 1856, contains the only figures published of the skull of *Aspredo.* Since these figures are inexact in several respects I add a figure of the dorsal aspect of the skull, etc. of *Aspredo aspredo.*—C. H. Eigenmann.

The Barn Owl in Minnesota.—Three barn owls, *Strix pratincola*, were recently taken from a hollow tree near Waterville, Minnesota and are still alive and in possession of Chas. A. Gray of that place. The fact is interesting since barn owls are scarcely ever found this far north.

Mr. Gray says, "The birds are as healthy and strong as when I got them. They dislike cats and dogs and make a hissing noise when these animals are near. When alone at night they make the same noise with a gurgling sound. When I talk to them they sway their bodies back and forth like some wild animals in cages. They live on rabbits and birds, are very tame and like to be petted as much as a dog."

As is often the case, these birds have excited considerable curiosity and photographs have been taken and sent to several places.

—U. O. Cox.

The Ruffed Grouse in Hudson, Ohio.—This is a small village with an area of two and a half square miles and a population of about 1200.

Three years ago in September a Ruffed Grouse (*Bonasa umbellus*) was observed in the central part of the village feeding upon grapes on a vine covering the top of an apple tree. By common consent, care was taken that it should not be disturbed or frightened. It remained

during the fall and winter, most of the time in the same block. It has returned each fall and remained until spring, and is now with us. It forages about the dwellings; feeding on the vines of the barberry, ampelopsis etc.; picking the white clover on the lawns and towards spring feeding on the buds of the apple trees. There are a few houses around which it delights to forage, where its tracks in the snow are to be seen at daylight and where it is often seen by day. It moves about with the characteristic caution of the wild bird, but has lost much of its timidity, as one can approach within 10 or 12 feet of it without disturbing it. Our hopes that it would return some fall with a mate have not been realized. The familiarity of the returning bird with its old favorite haunts, establishes its identity.

—M. C. Read.

On some Peculiarities in the Structure of the Cervical Vertebræ in the existing Monotremata.—For a long time I have been acquainted with the peculiar fact that the cervical vertebræ of Ornithorhynchus and Echidna are devoid of præ and postzygapophyses. In these forms therefore the cervical vertebræ are only connected with each other by the centra of the vertebræ and not by the arches. I do not know whether this condition is mentioned by Gervais, in his Osteographie des Monotremes, 1877, this work being not at hand. But since it is not noticed by Flower and Lydeker in their work, An Introduction to the study of Mammals, Living and Extinct, London 1891, nor in Flower's Osteology of Mammals, I should like to call the attention to it. I have observed this peculiarity in all the living forms of the Monotremata: *Ornithorhynchus, Echidna, Proechidna,* and it is very interesting to see that the same condition is found in two families so completely separated. I do not remember a similar case among any of the higher vertebrates.—G. Baur, *Clark University, Worcester, Mass., Jan.* 11, 1892.

The Armadillo (*Tatusia peba*) **in Texas.**—It may be of interest to some of your readers to know that the Armadillo, which has been supposed to occur in Texas only in the extreme south-west, is gradually ranging eastward.

During the past Summer a specimen was taken within a few miles of Austin and is now in our museum. Several have been seen on Onion Creek just south of here and they are quite numerous on the Navidad river in Lavaca County east of the ninety-seventh degree of longitude.—E. T. Dumble, *State Geologist.*

The Arachnoid of the Brain.—In the N. Y. Medical Record, Aug. 15, 1891, Dr. F. W. Langdon publishes some new observations on the Arachnoid of the Brain which are summarized as follows.

"1. The arachnoid membrane is a true shut sac, similar in structure and function to the serous membrane of the other great cavities. Its parietal layer is easily separable from the dura at the vertex in the fœtus and young infant, but practically inseparable in this region in the adults. At the base of the skull it is demonstrable as a separate membrane even in the adult. To assert that the parietal layer of the arachnoid is absent, because its subepithelial connective tissue has fused at the vertex with the dura (connective tissue) is as incorrect as to describe the great omentum as one layer of peritoneum, because its original four layers have become matted and adherent."

"2. The arachnoid cavity communicates freely with the subarachnoid space, by means of two foramina situated in the visceral arachnoid, one on either side of the medulla. For these I would propose the name 'lunulate foramina,' from their crescentic or lunulated edges, produced by the attachments of fibrous bands which cross the openings transversely. Subsequent observations, in two instances, confirm the presence of the 'lunulate foramina.' In one of these, the basilar process of the occipital and the sphenoid body were cut away from the base and the dura removed, so as to show the foramina *in situ*; thus excluding the possibility of their artificial production during the extraction of the brain."

EMBRYOLOGY.[1]

On the Development of Nereis dumerilii.[2]—Though this is but the first part of a contribution to the development of Annelids, to be followed by an account of the formation of the organs, yet the untimely death of the author makes it almost necessary to regard the present contribution as complete.

The very interesting series of forms discovered by Claparède in this single species, *N. dumerilii*, have been again studied by the present author, who believes their interrelations to be the following:

A small Nereis 12-15 mm. long in an immature state may have two quite different fates. It may transform in September and October into a pelagic Heteronereis, becoming sexually mature in February and March, and depositing pelagic eggs that contain little yolk and develop *with a metamorphosis;* it may grow to a length of 15-30 mm. and then become sexually mature as a Nereis laying eggs in tubes in April to July, which eggs contain much yolk and develop *without a metamorphosis;* or still growing, in June and July become a Heteronereis 55-65 mm. long that lays eggs in tube, with little yolk and *probably* developing with a metamorphosis.

There are thus two *Heteronereis states*, a little one with pelagic habits and metamorphosis and a large one without any pelagic life, and unknown, probably, indirect development. There are two *Nereis states*, one small and immature, the other large and either on the road to the large Heteronereis state or becoming a sexual Nereis with a direct development. It is this last large sexual Nereis that is treated of in the present article.

Obviously much yet remains to be done here by one having control of aquaria for long periods, as it is still unknown what may be the causes leading to the acquirement of these various states or whether there is any regular sequence or alternation in their occurrence. This could be done upon the common, equally polymorphic, Nereis of our coast!

In all forms of *Nereis dumerilii* the sexes are separate. In the large Nereis state studied, the females readily lay the eggs in transparent tubes (secreted by the parapodial and other epidermal glands)

[1]Edited by Dr. T. H. Morgan, Bryn Mawr, Pa.

[2]Dr. C. V. Wistinghausen in Mitth. Zool. Sta. Neapel. 10, July, 1891, pp. 41–72. Pl. 6–7.

when kept in aquaria with ulva, which they eat. The male enters the tube only to fertilize the eggs as they are laid. From the tubes the eggs may be removed with care from holes cut in the side; but the female must not be disturbed, as the undulatory movements of its body within the tube are necessary in supplying the eggs with fresh water.

When no male is present the females abandon the tubes and lay the eggs at random in the water, where they do not develop.

No time limits can be set to the processes of development, as they vary so exceedingly at different temperatures. It is interesting to note that the author finds the Winter season very unfavorable, since a large proportion of the eggs then develop abnormally in the laboratory, but not outside. This would seem another illustration of the advantage derived from a climate in which air and water are of about the same temperature. At Messina the eggs are laid, in aquaria, between eleven and twelve in the morning regularly, this being a decided exception to the many cases in which the night time is the laying period.

In the investigation both surface views and sections were made use of, the former either alive or stained in Kleinenberg's hæmatoxylin after hardening in picro-sulphuric, while the section material was hardened in Fol's modification of Flemming's fluid.

The author's summary of results obtained is about as follows: Cleavage is total and unequal; four blastomeres bud off four micromeres called *encephaloblasts*, as they give rise to the cephalic ganglia and all the sense organs of the head. The largest of the four micromeres buds off *two* large cells called *somatoblasts*, as they form all the body except the mid gut and the epidermis. The three other micromeres, equal in size, bud off each two small cells, and these *six* micromeres take no part in the formation of organs, but merely form the epidermis and the larval prototroch.

The embryo arises from two quite separate masses, the one, the trunk arising from the two somatoblasts, the other, the head, formed by the four encephaloblasts. These two elements subsequently unite. The embryo is hatched with three pairs of functional parapodia, the development being thus direct.

Without the aid of the author's figures it is difficult to explain many of the points of interest in the paper, not all of which are included in the above summary.

The large amount of yolk present remains in four masses, the micromeres, which are epibolically overgrown by a very thin layer of nucleated protoplasm furnished by the cells budded off from the mic-

romeres, namely the four encephaloblasts, two somatoblasts and six micromeres.

These four micromeres form the digestive tract, the other cells the ecto- and mesoblasts. The four yolk masses at first have but one nucleus each, but subsequently by what seems amitotic division, new nuclei, accompanied by a little protoplasm, arise in the yolk and envelops it in such a way as to preserve the original lines of cleavage between the four masses. These come to lie around, not in, the digestive tract, the yolk being still in four masses in the latest embryo.

The persistence of these cleavage planes of the micromeres enables one to refer them to the subsequent planes of the animal.

The animal pole is anterior, and the first two meridianal planes result in the formation of two smaller central cells and a small and a larger dorsal cell, the larger cell being on the left of the animal.

Without entering into the author's comparison between the phenomena found in this Nereis and those recently discovered in other Polychætæ, Oligochætæ and leeches we must refer to the way in which the two somatoblasts give rise to the trunk as it bears upon the question of "teloblasts." The first formed somatoblast divides into four cells in a transverse row, and these again divide to form a parallel row from which other cells bud off, making twelve in four longitudinal rows, two on each side the median plane. The division of the second somatoblast results in the formation of three transverse series, of which the upper is composed of five or six larger cells that seem to give off the other cells in longitudinal rows. These six larger cells sink in and as *myoblasts* form the musculature, while all the other descendants of the somatoblasts form nervous system, setæ sacs, etc.

Obviously all these cells represent the "ventral plate" found by Wilson in a Heteronereis, while the two somatoblasts are identical with the "primary toloblasts," though Wistinghausen seems to avoid the use of the term teloblast as long as there are no long lines of cells leading directly from a mother cell to the formed organ.

The prototroch forms but a rudimentary simple band of ciliated cells rotating the embryo. The anus would appear to arise at the point of closure of the blastopore. The formation of organs in the trunk, on the surface of a spherical mass of yolk has much to recall stages in the embyology of an arthropod. Finally the head and trunk organs unite when the œsophageal commissures are formed by growths from both foundations.

The embryo elongates and hatches in an imperfect state with three pairs of setigerous parapodia, partly formed fourth somite, head and tail, anal and cephalic tentacles.

A just estimate of the paper can be formed only with the appearance of the full account of the American species studied by Wilson. From the preliminary account it seems that, allowing for the differences due to a direct and an indirect development and the difficulties offered by an opaque as opposed to a transparent object; the embryology of these two species of Nereis has very much in common, strengthening the theoretical conclusions that may be drawn from either and rendering of little use the previous imperfect studies of the same subject.

Development of the Lobster.[1]—Mr. H. C. Bumpus publishes a contribution to the Embryology of the American Lobster. Many females seem to be impregnated with spermatozoa long before they are able to deposit eggs, which cannot take place until a year if not two years later. The author has discovered in the female a receptive apparatus for the spermatozoa. " This organ lies at the posterior end of the sternum of the female lobster, resting between the bases of the IV and V pairs of thoracic appendages."

The eggs are deposited (on abdomen) in July and August, and develop rapidly so long as the water is relatively warm. Certain precocious eggs may exceptionally hatch before winter. This is not the rule, for ordinarily the eggs hatch between the middle of May and the middle of July of the following year.

The nucleus of the egg divides and re-divides before the protoplasm (and yolk) of the egg shows any traces of division. When nuclear division has taken place about three time elevations and furrows appear on the surface, at first only at the animal pole.

Later the lower pole is divided and all the furrows extend deeper into the yolk, "though there is shown a central mass of yolk that remains undivided." On the third or fourth day after oviposition the Gastrula is formed.

The rest of the paper deals with the later stages of development.

Embryology of the American Alligator.—Dr. S. F. Clark publishes in the September number of the Journal of Morphology[2] a paper on the habits and embryology of the American Alligator. The

[1]Journ. Morph., Vol. V, No. 2.

[2]Journ. Morph., V, No. 2.

first part of the paper deals with the author's visits to Florida and his own and others' observations on the habits of the alligator.

The times of laying lie between June 9th and 17th, "while it is probable their eggs are occasionally laid somewhat later. I doubt if they are ever laid much before the 9th."

The nest is very large and is built by the female, and it is probable that the same nest may be used more than once but not more than once each year.

In counting lots of eggs the number averaged twenty-eight each. Fine plates accompany the paper giving the superficial structure of the stages of development. Unfortunately none of the internal changes are given, and the text is a very brief description of the fifty-one figures.

The author's purpose is to furnish a general account or outline of the forming of the alligator as seen in external features.

"I have been led to do this by reason of the entire lack of any embryological knowledge of the alligator group, and on account of there still being something to be desired in the way of a set of general figures illustrating the development of a reptile."

ENTOMOLOGY.[1]

The Ox Warble Fly.—*The Journal of Comparative Medicine and Veterinary Archives* for June, 1891, contains an article by Dr. Cooper Curtis upon the "Oxwarble in the United States." Dr. Curtis reviews the literature of the subject and shows that what American writers have thought to be *Hypoderma bovis*, is really *H. lineata*. Larvæ of this insect having been found in the œsophagus, under the pleura near the eleventh rib, and in the subcutaneous tissue of the back, led Dr. Curtis to conclude that the life history of this insect is not as has been supposed; i. e. that the eggs are laid along the backs of cattle, and upon hatching, the young larvæ bore into the skin. If no larvæ or "wolves" are found in the backs of cattle until January, it is probable that the eggs are taken into the mouth and the larvæ go from the œsophagus to the back.—HOWARD EVARTS WEED, *Mississippi Agricultural College.*

Spontaneous Ignition of Carbon Bisulphide.—According to a recent issue of the *Scientific American Supplement*, Dr. Max Popel

[1]Conducted by Prof. C. M. Weed, Hanover, N. H.

recorded a case in which carbon bisulphide mixed with air was ignited by an arm of the pipe through which it was passing being unscrewed. Dr. Popel has also found that "mixtures of carbon bisulphide and air readily ignite when brought into contact with iron pipes through which steam at ¾ atmosphere (135°—145° C.) is passing, the less carbon bisulphide there is in the mixture the higher is its ignition point, and the sharper the explosion." This substance is now extensively used to clear mills of insects, and the caution is common to see that no fire in any form reaches the rooms where it is in use. The facts above given emphasize the necessity not only of cautioning against fire, but also against the presence of steam or hot water pipes; and perhaps also against making the treatment on a hot summer's day.

A Collection of Exotic Insects.—I recently had the pleasure of looking over a magnificent collection of exotic insects, owned by Mr. John D. Locke, of Haverhill, New Hampshire; and was surprised to find so rare a lot of insects known to very few entomologists. The collection was purchased by Mr. Locke, who is an enthusiastic naturalist, a few years ago in Vienna, of the widow of a Professor Schneider, the latter having spent a life-time in getting it together. The collection consists chiefly of Lepidoptera and Coleoptera, and contains specimens from all over the world. Many of the butterflies, moths and beetles are of gigantic size: e. g., the Atlas moth from India, which measures 9x6½ inches; *Erebus agropyrus* from South America which measures 10 inches across the wings; *Phaomagigas,* a "lantern fly" which is 10 inches long, and the mammoth Goliath beetles which must be seen to be appreciated. Fortunately the collection is in good hands, and is carefully gone over at stated intervals and kept free from pests and dust.—CLARENCE M. WEED.

Entomological Notes.—The Horn Fly (*Hæmatobia serrata*) according to a recent report from Mr. H. E. Weed, of Mississippi, has appeared in that state in sufficient numbers to attract the attention of farmers. It seems destined to spread widely and rapidly.

Professor A. J. Cook is to spend the Winter in California.

In a recent *Nature* we find this item: "Every one interested in the scientific aspects of agriculture was sorry to hear that Miss Ormerod had felt it necessary to resign her position as consulting entomologist of the Royal Agricultural Society. It is much to be regretted that misunderstandings should have led to the severance of her connection with the Society with which she has so long been hon-

orably associated. Fortunately her work as an entomologist is not to be interrupted, and she will continue to place her knowledge at the service of agriculturists."

The newspapers report that a large manufacturing building at Springfield, Illinois, has been riddled by an insect borer, apparently a small beetle.

MICROSCOPY.[1]

A New Method of Using Celloidin for Serial Section Cutting.—The following has several features which recommend it as preferable to the ordinary methods of section cutting.—It allows a perfect orientation; the entire object is visible during the process of cutting; yolk-bearing eggs offer no serious difficulty; sections of large area and of unusual thinness are easily secured; crimping and curling during the process of clearing are avoided and the sections may be readily arranged in series.

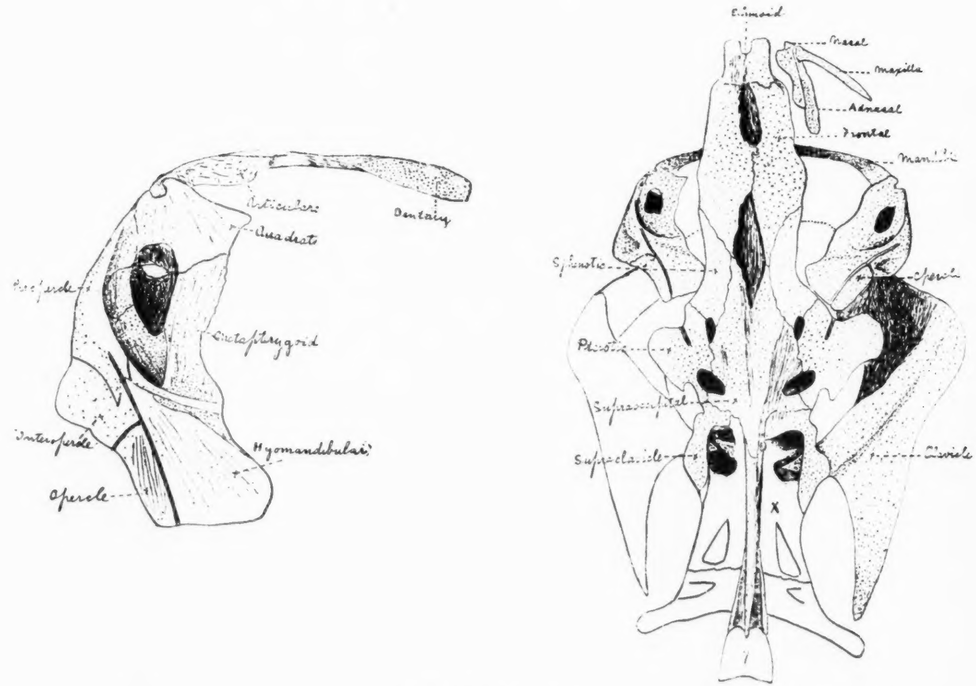
The object is first stained *in toto*, dehydrated, infiltrated with thin, medium and thick celloidin or collodion, (Squibbs Flexible Collodion rendered thick by evaporation is excellent) and finally placed in a paper tray filled with the thick collodion. In a few moments a film will form over the exposed surface of the collodion, when the paper tray with its contents is thrown into a jar of strong chloroform, in which after a few hours, the collodion becomes quite hard. Thus far we have been following only the more ordinary methods.

The tray is now taken from the chloroform and, after the paper has been removed from the hardened block, the collodion with its enclosed object is placed in a vial of white oil of thyme, or some other similar oil. If the block of collodion is not large, in a few hours it will become as clear as glass, the stained object appearing as if suspended in a transparent fluid.

For the process of orienting, the block of collodion may now be taken from the oil, placed in a watch crystal and, after covering with the oil of thyme, examined with a lens or, if more desirable, with a compound microscope. The side of the block that is to be attached to the object holder of the minotome is now selected, wiped dry of the oil and immersed for a moment in ether and then smeared with thick collodion. The object holder, a block of wood rather than cork, is

[1]Edited by C. O. Whitman, Clark University, Worcester, Mass.

PLATE VI.



Skull of Aspredo.

smeared in the same way and the two collodionized surfaces are brought together. The holder and collodion block are now immersed for a few minutes in chloroform, or long enough for them to become firmly united.

The preparation is now screwed between the jaws of the object-carrier of the minotome and covered, by means of a camel's hair brush, with oil of thyme. The minotome knife is flooded with the same oil. The oil, which thus takes the place of alcohol usually used, has the advantage because of its lubricating property, of not only permitting thin sections to be cut, but its slow evaporation allows one to leave his work at anytime for minutes or even hours without the object being injured.

After a few sections have been cut from the block of collodion, the relative position of the plane of the knife to the axis of the object can be definitely established. I have had no difficulty in orienting small Arthropod embryos by simply examining the object and plane of cutting at this time with a compound microscope. The segments, appendages and even nuclei being as clearly shown as if mounted in balsam.

The object, satisfactorily oriented, is now cut and the sections at once transferred to the slides, covered with balsam and mounted, or, if they are not immediately needed, they may be kept indefinitely in a vial of the oil.

If the sections are to be arranged 'in series,' they are simply placed upon a slide one after the other, care being taken not to flood the slide with oil but to keep it quite dry. After the sections are arranged, the slide is tilted up to allow the excess of oil to drain away, fifteen minutes generally being sufficient. Balsam is now placed on the sections and a warm cover is allowed to gently fall over the series, no section of which ought to leave its place.

The above method is especially useful in the preparation of larger yolk-bearing eggs.—H. C. BUMPUS, *Brown University, Prov., R. I., Dec.,* 14, 1891.

Imbedding Blastoderm of Chick in Collodion.[1]—For sectioning, blastoderms should be dehydrated, either before or after staining, as is thought best, and immediately transferred to a thin solution of collodion[2] (2 per cent.,) after which they are placed in a

[1]Gage & Hopkins, Proc. Am. Soc. Microscopist, 1890, p. 129.

[2]We have found collodion more satisfactory, on the whole than celloidin and it is less costly.

To make a two per cent. solution, dissolve 2 grams of gun-cotton in 100 c. c. of sulphuric ether and 95 per cent. alcohol, equal parts of each. For a 5 per cent. solution use 5 grams of gun-cotton instead of 2.

thick solution of collodion (5 per cent.) and then arranged for imbedding and sectioning. To accomplish this, the following procedure has been found useful:

With a camel's hair brush transfer the blastoderm from 95 per cent. alcohol to a paper box. It is better to fill this box partly full of alchohol (95 per cent.) before transferring the blastoderm to it, as the alcohol partially floats the blastoderm and thus facilitates its removal from the brush. As soon as the blastoderm is safely in the box, remove the alchohol with a dropper (do not try to pour it off, otherwise the blastoderm will curl up) and carefully pour in enough thin collodion to cover the blastoderm to the depth of about ½ c.m. The box is now placed in a tightly covered jar to prevent too rapid evaporation and the consequent solidification of the collodion. After the blastoderm has remained a sufficient length of time (from one to three or more hours, depending on the size of the blastoderm) in the thin solution, the collodion is removed with a dropper, and the thick solution poured on. After infiltrating sufficiently with thick collodion, 2 to 10 hours, open the jar and allow a film to form on the surface of the collodion, then fill the paper box with alcohol (60 to 80 per cent.) and allow it to remain until the collodion becomes firm and tough; two to four hours is usually sufficient. Now with a sharp knife a square or rectangular piece of collodion including the blastoderm is cut out and arranged on the cork in any position desired; the block is fastened to the cork, as any ordinary tissue, by simply pouring over it thick collodion, which is hardened by immersing in alcohol (60 to 80 per cent.) for from 5 to 15 hours.

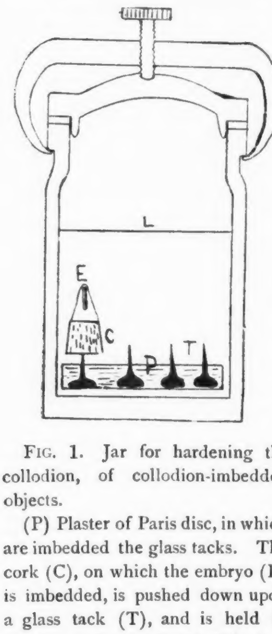


FIG. 1. Jar for hardening the collodion, of collodion-imbedded objects.

(P) Plaster of Paris disc, in which are imbedded the glass tacks. The cork (C), on which the embryo (E) is imbedded, is pushed down upon a glass tack (T), and is held in position under the liquid (L), alcohol or chloroform, while the collodion is hardening.

For holding the corks under the alcohol the following apparatus has been found more economical and convenient than the method of

attaching weights to the corks. The apparatus consists simply of a glass jar, in the bottom of which are fastened several rows of glass tacks. The material necessary for its construction consist of a wide-mouthed jar, a few pieces of glass rod, and a little plaster of Paris. The tacks are made by heating the glass rod and drawing it out to a rather sharp point. It is then cut off at the right length and the cut end softened by heat and then quickly pressed upon some hard surface, so as to form a sort of head. The tacks are then arranged in rows in some shallow dish, previously oiled, and enough plaster of Paris poured around them to form a layer 1½ to 2 c.m. deep. When this hardens, the tacks are firmly held in an upright position, and all that remains to be done is to place the plaster disc in the bottom of the glass jar.

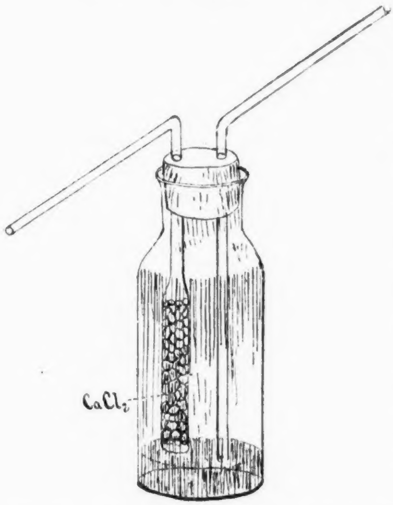


FIG. II. Ether wash-bottle for blowing ether vapor upon collodion or celloidin sections to fasten them to the slide. The tube of calcium chloride (Ca Cl 2) is for dehydrating the ether vapor.

To use the apparatus, fill it partly full of alcohol (60 to 80 per cent.). As the specimens are imbedded on the corks, transfer them to this jar, sticking each cork upon a tack.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

The American Society of Naturalists—Met in Philadelphia, December 29th and 30th, 1891. They discussed a salient point in evolution on the morning of the 30th, and in the afternoon listened to the descriptions of three important expeditions which went out in 1891. The morning session was given up to the reading of four papers on "Definite vs. Fortuitous Variation in Animals and Plants." Professor Thomas Meehan, Professor J. P. McMurrich, Professor J. A. Allen and

Professor E. D. Cope each read papers on their separate specialties in reference to the subject under discussion. The meeting was called to order on the 29th, by the President, Professor Rice, and the report of the Treasurer of the society was approved. Among the other items in the Treasurer's report was $100 as a subscription to the "American table" at the Naples Zoological Station. Professor H. F. Osborn, of Princeton, introduced Professor Charles W. Stiles, of Washington, that the latter might describe the present status of the Naples Station.

Professor Stiles told of the excellent work done at Naples, where a laboratory has been erected, which is now a centre of investigation for naturalists all over the world. Here the most eminent scientists of all nations assemble to exchange views and study the life that teems in the Bay of Naples. Almost every nation in the world has made a subscription to the station in the form of an endowment for a "table," at which the distinguished scholars may study. The United States was represented for three years through the Smithsonian Institution, but for many years there has been no American table, and those American students who visit the Biological Station do so as a courtesy from foreign nations. The cost of a table is $500 a year.

The American Association for the Advancement of Science has made a donation of $100, which, with the present donation and one or two other gifts from colleges, will greatly aid the work, so that an American table will almost certainly be maintained in 1892.

Looking toward the future maintenance of this table, the Executive Committee recommended that the society memorialize the Smithsonian Institution, recommending that the Institution assume the responsibility of maintaining an American table at the Naples Zoological Station in future years. This recommendation was adopted.

The following members were elected: George V. McLanthalen, Massachusetts Institute of Technology: Henry B. Ward, Harvard College; Charles W. Stiles, Department of Agriculture, Washington; George W. Fuller, Biologist, Massachusetts Board of Health; J. E. Ives, Philadelphia Academy; Robert P. Bigelow, Johns Hopkins University; Alexander H. Philip, Princeton College; Charles Freeman William McClure, Princeton College; William A. Setchell, Yale College; Joel A. Allen, American Museum of Natural History, New York; Henry A. Fernald, State College of Pennsylvania.

The Committee on Nominations recommended the following officers, who were unanimously elected: President, H. Fairfield Osborn, Columbia College; Vice-Presidents, Samuel F. Clarke, Williams College;

George Baur, Clark University; William H. Dall, Smithsonian Institution; Secretary, Thomas H. Morgan, Bryn Mawr College; Treasurer. William T. Sedwick, Massachusetts Institute of Technology; Members of the Executive Committee, J. Playfair McMurrich, University of Cincinnati; W. P. Wilson, University of Pennsylvania.

The papers of the session were then read in succession, a general discussion following. The subject under discussion was "Definite versus Fortuitous Variation." The subject is important to the naturalist as pointing out the method in which species are formed, whether as the result of definite or of purely accidental causes. The first paper was by Professor Thomas Meehan, and considered the question in reference to plants.

PROF. MEEHAN'S ADDRESS.—Professor Thomas Meehan remarked, in opening the discussion, that he was unable to get a distinct conception of definite as opposed to fortuitous variation, but would consider those variations definite that came in expected order and exerted no surprise, and those as fortuitous that were unexpected and unusual, as if influenced by some irregular law, dependent on accidental conditions.

A large number of American trees, he explained, had closely related species in the north of Europe. The American chestnut, he said, had for a relative the Spanish chestnut. It had smaller nuts, smaller twigs and buds, wider internodes, thinner and less serrate leaves, and changed to a bright color in fall. The two, it was assumed by evolutionists, had the same origin, only some accident, some fortuitous circumstance, led to the variation. Strange to say, all the other trees varied from their allies in just the same particulars. Could such a regular series of varitions be due to fortuity? What is more remarkable, this departure from the primitive parent must have been ages ago, yet through the long centuries, and over thousands of miles of varying conditions, the distinct character of these variations has remained the same.

Reference was then made to a large number of variations known in gardens as cut-leaved kinds, blood-leaved, weeping trees, and sports like the nectarine from the peach, and garden roses from the sporting branches—the parents as being under exactly similar conditions, as one great difficulty in believing environment, as generally understood, could have had much influence in producing them. Popular language called these incidents, and science fortuitous, but the element of change must have existed in the organized protoplasm of the single cell, and it was difficult to conceive of any external influence that could act on this single cell and not on those surrounding it.

Water plants, with the varying characteristics in proportion to their growth on land or in water, were referred to, rather as hereditary powers of adaptation than as acquired ones. Carnivorous plants and parasitic plants were referred to in the same connection.

Professor Meehan urged, however, that there were very strong facts in favor of fortuitous variation, as there must necessarily be, to draw so strong a support of that view from eminent men. A comparison of some trees of the Rocky Mountains with identical species on the Pacific was made. They undoubtedly had a common origin within comparatively recent times, and the elevation following the upheaval of the Rockies, was assumed to be the fortuitous circumstance influencing the change. Some of these had wandered so far apart as to be regarded in some cases as distinct species. The hardiness of magnolias, sweet gums and others, from Northern seed, as against seeds of Southern trees, was also touched on. On the other hand, annual plants would not resist frost. The same white frost killed foliage in these as probably did long ages ago.

Heredity was then taken up and the point made that, no matter how originating, all variation was hereditary when once introduced. In this respect there was no difference between what was recognized as a good species or a mere variety.

Concluding, he said: "To my mind it would be unjust to ignore the separate existence of either fortuitous or definite variations. We have not the remotest conception how either of these forces operate on protoplasm. They may eventually be found but varied manifestations of the same power; but while we are arguing as we are to-day, arguing on the separate nature of these two forces, we must concede considerable power to both, with by far the larger influence, to my mind, to definite variation."

Invertebrate Animals.—Professor McMurrich followed with the discussion of the question with reference to invertebrate animals. He compared the question not inaptly to the rolling of a spheroidal body having a larger number of facets over a hard surface. If the ball was uniformly balanced it was a matter of "chance" that is to say, of a large number of causes which could not be determined or analyzed as to which facet it would stop at. If, however, the ball was weighted it would stop definitely on a single facet, or one close to the one selected.

"At present," he said, "there are no extensive observations recorded on the question under discussion, although there are certain special cases which seem to bear more or less directly upon it. The most

noteworthy of these is the series of observations made by Schmankewitsch, on the effect of the degree of saltness of the water in which certain animals live upon the form of the body. The form experimented upon was a rather lowly organized crustacean, known as *Artemia salina*, which normally lives in water of a moderate degree of salinity. By gradually increasing the saltness of the water, in the course of several generations, the animals assumed the characteristics of an entirely different species, known as *A. muhlhausenii*. By gradually diluting the moderately salt water with fresh water until it becomes practically fresh, the *A. salina* gradually assumed structural characteristics which rendered it necessary to refer the forms thus obtained to an entirely different genus, *Branchipus*. Here we have, apparently, a very good case of the production of definite variations of form under the influence of external conditions.

A further study of the results, however, brought out some facts which diminish the value of these observations for our present purposes. It was shown that *A. salina* resembled an immature form of Branchipus, while *A. muhlhausenii* represents a stage which is passed over in the immature life of both Branchipus and *A. salina*. In other words, the effect of the salinity of the water was not to produce definite variations of the body form, but to produce an acceleration of the maturity of the reproductive elements, so that in the water of the greatest degree of saltness the animals became mature, while the body form was still in a larval condition.

A few cases have, however, come under my observation which have bearing on the subject. Among the Isopod crustacea of our coast is a form, Jæra, which presents a great variety of coloration; all the variations may however, be reduced to two types, one in which the coloration is uniformly distributed, and the other in which the pigment is arranged in transverse bands. Within these limits the variations are innumerable, but still the variations may be considered definite. A similar variability within definite limits has been described in another Isopod. In certain sea anemones, as well as in certain caterpillars, the color appeared to be due to environment purely.

Comparison of processes of variation to vicarious substitutions which occur in the more complicated silicates of the mineral world was made. The number of substitutions is limited, but within these limits the amount of variation is practically indefinite, if not infinite.

VERTEBRATED ANIMALS.—Professor Allen next spoke on "Variations in Vertebrated Animals. He confined his paper to variations

which occur in mammals and birds, as those which occur in the lower forms—reptiles and fishes—are less well known. He said that a rather wide range of individual variation is recognized as inherent in all animals. These variations, however, are usually confined within rather narrow constant limits, any considerable excess beyond the normal range coming into the category of sports and are popularly termed fortuitous. A step further gives malformations and monstrosities. Such extreme departures from the normal, while more rare, are probably no more fortuitous than those less marked. The only difference was that the immediate cause was hard to discover.

He illustrated this point by a number of examples, in which changes were plainly due to geographical and climatic forces. As a result biologists had accepted certain generalizations which might be stated as follows:

First. Baird's law of geographical variation in size, which, announced in 1865, still held its own. It asserted that there was a constant increase in the size of individuals of the same species from the south northward, and from the lowlands toward the higher elevations.

Second. The frequent increase in size of peripheral parts, as the tail, beak and claws of birds, took place from the north southward or inversely to the increase and general size.

Third. A general deepening of the coloration took place from the north southward in North America, east of the plains, together with a reduction of white markings and white areas, and a corresponding increase of dark markings and dark areas and a gradual increase in the intensity of iridescent tints in species thus marked.

Fourth. The loss of color over the interior in both mammals and birds having a continental distribution is marked.

Fifth. There is an extreme intensification of color over the heavy rainfall district of the Northwest coast.

The failure of verification of the first law led to its modification to the following formulæ, first published in 1876, which has stood the test of subsequent investigation:

First. The maximum physical development of the individual is attained where the conditions of environment are most favorable to the life of the species.

Second. The largest species of a group (genus, sub-family or family, as the case might be) are found where the group to which they severally belong reaches its highest development, or where it has what may be termed its centre of distribution.

Third. The most typical or most generalized representatives of a group are found also near its centre of distribution, outlying forms being generally more or less aberrant or specialized.

Many examples from animal and bird life were adduced, the most striking being that of the family of hares, which inhabits the whole of the United States. In conclusion the Professor said:

"While climatic variations are obviously definite, and while the direct action of external conditions exerts a powerful influence in moulding at least the superficial characters, these alone go but a little way toward accounting for the profounder modifications that distinguish the higher groups. For example, it is impossible to conceive that any amount of climatic variations could transform a song sparrow or a robin into a woodpecker or the reverse; in fact, make a woodpecker out of any other form of bird. Here functional evolution—change in habits, use or disuse of parts—must come strongly into play, and, to a less degree, food, isolation, interbreeding the struggle for existence, etc. The modification of organs, as the bill, the wings and tail, in birds, is, in my opinion, the result of definite variation, due to a variety of causes—never to fortuitous variation.

"The use to which an organ is put and its structure have evidently the relation of cause and effect. Modification of structure follow and are produced by change of habit. * * * As already intimated, my own studies have given no evidence of evolution through fortuitous variation; the evidence is all in the other direction. I cannot even conceive of the evolution of a new form through an accidental variation, since the individual in which it appears must necessarily pair with a normal individual, and can thus transmit the new variation only in a lessened degree to its offspring, to be again diluted in the next generation through precisely similar contingencies, and so on until the original deviation is obliterated."

Fossil Vertebrata.—Professor Cope spoke on the subject from his standpoint.

He discussed the evidence as to the nature of variation as presented by the extinct vertebrata. He remarked that one difficulty attends this branch of the subject in the circumstance that we do not generally possess enough perfect specimens of any one species of extinct vertebrate to make sure of what its variations may have been. Thus it is that in this case we cannot prove that many variations may have existed of a more or less promiscuous character; but it nevertheless remains that the branch of the subject shows that variation has also

been direct. It is only necessary to call attention to the leading facts, now well known, thanks largely to the investigations of Americans, of the evolution of the vertebrate skeleton.

He commenced with the highest class, the mammalia, where the evidence is very complete. Such is the simple fact of numerical digital reduction from five in the lower ungulates through the numbers four and three to one, as in the horse; or to four and two, as in the ox and deer. Then carrying the line of variation towards the central parts of the skeleton, Professor Cope described the articulation of the limbs. The development of keels on the metacarpals was mentioned; then the development of facets on the radius at the wrist. Next, the development of the tongue and groove articulation between the radius and ulna proximally, and next the same in the humerus and radius at the elbow. The successive reduction of the ulna was mentioned. The hind limb was next considered, and the progressive process of development was described. The intervertebral articulations were then discussed, and their successive modifications in the artiodactyla described.

These characters all indicate a direct variation of individuals in the direction of perfect mechanical contrivances in the skeleton.

Professor Cope then referred to the presence of the same phenomenon in the dentition of mammalia. He dwelt especially on the evolution of the sectorial teeth of carnivorous forms, from the tritubercular upper molar and tuberculosectorial inferior molar.

The successive variations seen in the reptilian skeleton were then referred to. The development of fins from ambulatory limbs in the Ichthyosauria; next of upright walking types, like the birds, in the Dinosauria, with the pelvic bones thrown back to sustain the weight of the viscera in the same position. Next the evolution of the modern types of lizards and snakes by the development in the length of the suspensoria of the lower jaw to enlarge the gape for swallowing; and second, in the loss of the capitular articulations of the ribs, due to the support of the weight on the ground, just as occurs in the Plesiosaurian reptiles and in the whales, where the body is supported by the water.

Professor Cope stated that his conclusion from these and many other similar facts was that the origin of such variations had not been promiscuous or fortuitous, but direct, and in consequence of the operation of a definite cause. That cause he believed to be growth energy (of which we know little or nothing), directed by the mechanical relations between the animal and its environment.

He stated that this relation determined the forms of the bones and the muscles which moved them. These determined the general arrangement of the viscera and of the circulatory system which supplies nutrition. Behind all other systems, however, lies the nervous system, the director of motion, and this was serially and successively developed under the influence of use, which developed intelligence out of simple sensibility and memory.

Following Professor Cope's paper there was a lively and protracted discussion upon all, participated in by a majority of the members present. Most of the arguments were favorable to definite variation, though the other branch of the topic had a few supporters. For over an hour the discussion was kept up, becoming more interesting with every new phase or branch of the subject presented.

Those who took part in the discussion were Professors George Macloskie, H. W. Conn, J. A. Ryder, George Baur, C. B. Davenport, J. T. Rothrock, H. F. Osborn, H. P. Bowditch, J. P. McMurrich, J. A. Allen, E. D. Cope, W. P. Wilson, T. H. Morgan, R. P. Bigelow, C. W. Stiles, William Libbey, Jr., E. A. Andrews.

Prof. Macloskie, speaking on the mechanical growth, argued that the place where the bones really grow is not where they rub together but another part. Also, that it is an important thing that the environment may retard growth while the reproductive parts are active, and in this way changes may occur on account of the environment.

Prof. Osborn did not think that the evidence was conclusive, for, taking into consideration all cases of the kind, there are some exceptions to the principle that bear strongly against it.

Two points were made by Prof. Conn. First, on the tendency of aquatic beetle larvæ to assume similar forms, in spite of the wide difference and relations of the adults; and second, that in the discussion nothing had been said about indirect or congenital variations.

Professor McMurrich brought out more fully the points of his paper, showing that all variations which are transmitted must pass through the germ cells; that the egg must carry the variation. Also that there is such a thing as individual variation, which does not need to be transmitted.

The second annual meeting of the **American Morphological Society** was held at the Academy of Natural Sciences, Philadelphia, December 28th and 29th. The attendance was good, and much interest was manifested in the proceedings of the Society. The following are the titles of the papers read: R. P. Bigelow, On the development of sense-organs of the Guinea Corn-blubber (Cassiopea); E. D. Cope. On

the degeneracy of the scapular and pelvic arches in the Lacertilia; E. B. Wilson, The relation between bilateral symmetry and the cleavage of the ovum; H. F. Osborn, The dentition of Palæonictis, Amblyctonus and Oxyænas; J. P. McMurrich, On the early development of the marine Isopod Jæra; G. Baur, On variation in the genus Tropidurus; C. W. Stiles, On *Spiroptera scutata* Müller: H. F. Osborn, The Evolution of the mammalian molars to and from the tritubercu-late type; H. B. Ward, Some notes on Nectonema.

The officers for the current year are: President, Professor C. O. Whitman; Vice-President, Professor H. F. Osborn; Secretary-Treasurer, Professor J. P. McMurrich; Members, with the preceding, of the Executive Committee, Professors E. L. Mark and T. H. Morgan.

The Indiana Academy of Science held its seventh annual session in the capitol at Indianapolis, December 30 and 31, 1891. The president of this meeting was Prof. O. P. Hay, Butler University, Irvington, Ind. The unusual number of 98 papers were entered, requiring the Academy to meet, except Wednesday morning and night, in two sections; one devoted to Zoology, Botany and Geology, the other to Physics, Mathematics and Chemistry. Wednesday night President Hay delivered the customary address on "The present state of the Theory of Organic Evolution." The officers for next year are as follows:

President, J. L. CAMPBELL, Crawfordsville, Ind.

Vice-Presidents, J. C. ARTHUR, Lafayette, Ind., W. A. NOYES, Terre Haute, Ind.

Secretary, A. W. BUTLER, Brookville, Ind.

Treasurer, C. A. WALDO, Greencastle, Ind.

Auditors, P. S. BAKER, Greencastle, Ind. W. W. Norman, Greencastle, Ind.

Curators:—

Botany, J. M. COULTER,
Ichthyology, C. H. EIGENMANN,
Geology, S. S. GORBY,
Ornithology, A. W. BUTLER,
Herpetology, O. P. HAY.
Entomology, F. M. WEBSTER,
Mammalogy, E. R. QUICK.

The summer meeting of the Academy will be held by invitation of the faculty of Earlham College, at Richmond, Ind., in May next. At the same time and place will be held the meeting of the Mathematical

sections of the State College Association and of the Teachers Association.

The following papers were read:—

Some suggestions to Teachers of Science or Mathematics in High Schools,.. .T. C. Van Nuys

Notes on Numerical Radices, ...C. A. Waldo

The Kankakee and pure water for Northwestern Indiana and Chicago,................................. ....J. L. Campbell

Biological Surveys..John M. Coulter

The distribution of tropical forms in Peninsular Florida, ...L. M. Underwood

Unused Forest Resources. ....Stanley Coulter

Preliminary Notes on the Geology of Dearborn county, Ind. ....A. J. Bigney

Jefferson County Cystidians................................Geo. C. Hubbard

Hudson River fossils of Jefferson county, Ind..........Geo. C. Hubbard

The Upper limit of the Lower Silurian at Madison, Ind. ....Geo. C. Hubbard

Variations in the Dynamical Conditions during the deposit Rock beds at Richmond, Ind., By title ....Joseph Moore

The relation of the Keokuk groups of Montgomery county, with the typical locality.................................C. S. Beachler

Comments on the description of species......................C. S. Beachler

On a deposit of Vertebrate fossils in Colorado..........Amos W. Butler

Topographical evidence of a great and sudden diminution of the ancient water supply of the Wabash river, By title.............................. ....J. T. Campbell

Source of supply to Medial morains probably from the bottom of the Glacial Channel, By title.........................J. T. Campbell

Notes on a Kansas species of Buckeye...................W. A. Kellerman

On the occurrence of certain Western Plants, near Columbus, Ohio...... ....Aug. D. Selby

Preliminary notes on the genus of Hoffmanseggia.........E. M. Fisher

Preliminary notes on the Flora of Henry county, Ind., By title.....................T. B. Redding and Mrs. Rosa Redding Mikels

A new Microtome...Geo. C. Hubbard

Notes on the Organogeny of the Compositæ, By title......G. W. Martin

Notes on the development of the Archegonium and Fertilization in Tsuga canadensis and Pinus sylvestris........D. M. Mottier

Strange development of Stomata upon Carya alba caused by Phylloxera........................ ....D. A. Owen

Development of the Sporangium and Apical growth of stem of Botrychium virginianum...........................C. L. Holtzman

The Flora of Mt. Orizaba.......................................H. E. Seaton
An apparatus for determining the periodicity of Root Pressure..M. B. Thomas
Condensation of Acetophenone with Ketols, by means of dilute Potassium Cyanide...Alex. Smith
Condensation of Acetone with Benzoin, by means of dilute Potassium Cyanide...Alex. Smith
Pyrone and Pyridone derivatives from Benzoyl-acetone......Alex. Smith
Carbonic Acid in the Urine...........T. C. Van Nuys and R. E. Lyons
Results of Estimations of Chlorine in Mineral Waters, by Volhardt's Method.......................................Sherman Davis
The Sugar Beet in Indiana......................................H. A. Huston
Forms of Nitrogen for Wheat.................................H. A. Huston
A Copper Ammonium Oxide.....................................P. S. Baker
Di-benzyl carbinamine...W. A. Noyes
The Character of Well Waters in a thickly populated area, W. A. Noyes
Laboratory and Field Work on the Phosphate of Alumina, ...H. A. Huston
Recent Archæological discoveries in southern Ohio, ...Warren K. Moorehead
Photographing certain natural objects without a camera, ...W. A. Kellerman
Recent methods for the determination of Phosphoric Acid, ...H. A. Huston
The digestibility of the Pentose Carbohydrates, By title ....W. E. Stone
The action of Phenyl-hydrazin on Furfurol, By title......W. E. Stone
A Graphical Solution for Equations of Higher Degree, for both Real and Imaginary Roots.......................A. S. Hathaway
On some Theorems of Intergrations in Quaternions......A. S. Hathaway
The Section of the Anchor Ring..............................W. V. Brown
A note on the Early History of Potential Functions, A. S. Hathaway
Some Geometrical Propositions.................................C. A. Waldo
Some suggested changes in Notation............................R. L. Green
An adjustment for the Control Magnet on a Mirror Galvanometer..J. P. Naylor
A combined Wheatstone's Bridge and Potentiometer......J. P. Naylor
Hysteresis Curves for Mitis and other cast iron, J. E. Moore ....and E. M. Tingley
Heating of a Dielectric in a Condenser. Preliminary note ....Albert P. Carman

Science and the Columbia Exposition........................J. L. Campbell
Exploration of Mt. Orizaba......................................J. T. Scovell
Entomologizing in Mexico....................................W. S. Blatchley
Distribution of certain Forest Trees, By title............Stanley Coulter
Cleistogamy in Polygonium, By title........................Stanley Coulter
The Cactus Flora of the Southwest, By title...............W. H. Evans
Methods observed in Archæological research, By title,
....Warren K. Moorehead
The Prehistoric Earthworks of Henry county, Ind., By title
....T. B. Redding
A review of the Holconotidæ......................................A. B. Ulrey
Some additions to the State Flora from Putnam county
....L. M. Underwood
Connecting forms among the Polyporoid fungi.........L. M. Underwood
On LeConte's Terrapins, Emys concinna and E. floridana, By
title...O. P. Hay
The Eggs and Young of certain snakes, By title.............. O. P. Hay
Observations on the Turtles of the genus Malchlemys By
title...O. P. Hay
The Gryllidæ of Indiana...W. S. Blatchley
The outlook in the warfare against infection, By title, Theodore Potter
Our present knowledge concerning the Green Triton,......... O. P. Hay
The proper systematic name of the Prairie Rattlesnake......O. P. Hay
The Blind Crayfishes of Indiana......................................W. P. Hay
Remarks on the Crustaceans of Indiana...........................W. P. Hay
Notes on Elaps fulvus............. ....A. J. Bigney
Some observations on Heloderma suspectum..................D. A. Owen
Some observations on Photomicrography......................D. W. Dennis
Disease of the Sugar Beet Root................Miss Katherine E. Golden
Buffalo Gnats (Simulium) in Indiana and Illinois.........F. M. Webster
The development of the Viviparous fishes of California, By
title..Carl H. Eigenmann
Recent additions to the Icthyological Fauna of California, By
title..Carl H. Eigenmann
On Indiana Shrews...Amos W. Butler
Some observations on Indiana Birds.......................R. Wes. McBride
Notes on Indiana Birds.......................................Amos W. Butler
The scales of Lepidoptera.......................................M. B. Thomas
The Ægeria of Central Ohio.....................................D. S. Kellicott
Some Insects of Tasmania....................... ....F. M. Webster
Early published references to injurious Insects, By title, F. M. Webster

The continuity of the Germ Plasm in Vertebrates, By title ....Carl H. Eigenmann
Biological Stations, By title...............................Carl H. Eigenmann
The Eyes of Blind Fishes, By title.....................Carl H. Eigenmann
On the presence of an Operculum in the Aspredinidæ, By title ....Carl H. Eigenmann
Notes on Indiana Arididae. Description of one new species ....W. S. Blatchley
The relation of Neucleaplasm to Cytoplasm in the Segmenting Egg, By title..........................C. H. Eigenmann, R. L. Green
Plant Zones of Arizona, By title..........................D. T. McDougal
Relation of available Enzym in the Seed to Growth of the Plant..J. C. Arthur
The potato Tuber as a means of Transmitting Energy, J. C. Arthur
Contributions to a knowledge of the grain Toxoptera (Toxoptera graminum) By title..............................F. M. Webster

The Second Annual Meeting of the Nebraska Academy of Sciences, was held at the University of Nebraska, commencing Thursday, December 31, 1891. The following papers were read: The President's Address: Specialization in Science. (Dr. Kingsley being absent, the address was read by Dr. C. E. Bessey). The Slime Moulds of Crete, A. T. Bell; The Evolution of Oxygen by Plants, A. F. Woods; Additions to the Flora of Nebraska, Prof. G. D. Swezey; The Flora of the Black Hills. Dr. C. E. Bessey; Metabolism, Dr. H. B. Lowry; A Bacterial Disease of Corn, H. B. Duncanson; Notes on the Flora of the Artesian Well at Lincoln, J. R. Schofield. The officers for '92 are: President, Dr. Charles E. Bessey, Uni. Nebr., Lincoln; Vice-President, Prof. G. D. Swezey, Doane College, Crete; Secretary, W. Edgar Taylor, State Normal School, Peru; Custodian, Lawrence Bruner, Uni. Nebr., Lincoln; Trustees, E. T. Hartley, Lincoln and Dr. H. B. Lowry, Lincoln. W. E. TAYLOR, Sec'y.

Iowa Academy of Sciences.—The sixth annual session was held December 29, 30, 1891 at Des Moines, Iowa. The following papers were read:

Prof. C. C. Nutting—Address, "Systematic Zoology in Colleges."

Miss Minnie Howe—"Some Experiments for the Purpose of Determining the Active Principles of Bread Making."

J. E. Todd—"Striation of Rocks by River Ice." "Further Notes on the Great Central Plain of the Mississippi."

L. H. Pammel—"Bacteria of Milks," with exhibitions of cultures. "Report of Committee on State Flora." "Phœnological Notes." "Experiments in Prevention of Corn Smut."

Dr. W. B. Niles—"The Action of Disinfectants on Nutrient Media."

Herbert Osborn—"The Orthopterous Fauna of Iowa." "Notes on Certain Iowa Diptera."

F. M. Witter—"Notice of an Arrow Point from the Lœss in the City of Muscatine." "The Gas Wells near Letts, Iowa."

G. E. Patrick—"Can Fat be Fed into Milk? i. e. Can the Composition of Milk be Modified by Variations in the Kind of Food?" "Sugar Beets in Iowa."

R. E. Call—"An Abnormal Hyoid Bone in the Human Subject," with exhibition of specimen.

Herbert Osborn and H. A. Gossard—"Notes on Life History of Agallia sanguinolenta."

Charles R. Keyes—"Geological Structure and Relations of the Coal-Bearing Strata of Central Iowa." Brick and Other Clays of Des Moines." "Aluminum in Iowa."

Prof. E. Haworth—(1) "Melanite from Missouri." (2) "Limonite pseudomorphous after Calcite." (3) "Prismatic Sandstone from Madison County, Missouri."

Prof. H. L. Bruner—"Aboriginal Rock Mortar."

Prof. J. L. Tilton—"A Three Legged Snowbird."

Prof. Calvin—"Distinctions between Acervularia davidsonii and A. profunda."

Prof. S. E. Meek—"Fish Fauna of Arkansas and Iowa compared."

Prof. T. H. McBride—"Slime Moulds of Iowa."

Prof. R. E. Call—"The present Status of Artesian Well investigation in Iowa."

Prof. C. C. Nutting—"Report of Committee on State Fauna."

The following Officers for 1892 were elected.

President, C. C. Nutting, Iowa City. First Vice President, L. H. Pammel, Ames. Second Vice President, E. Haworth, Oskaloosa. Secretary and Treasurer, Herbert Osborn, Ames. Executive Council, The Officers, and J. E. Todd, Tabor, F. M. Witter, Muscatine, R. E. Call, Des Moines.

Natural Science Association of Staten Island.—*October 10th*, 1891.—Informal meeting.

The following paper, by Mr. Chas. W. Leng, was read:

Notes of the tribe Hispini. The habits of certain species of Chrysomelidæ, members of the tribe Hispini, were first made known by Dr. Harris in the year 1835, in the Boston Journal of Natural History (vol. I. pp. 141–147) and were restated in his "Insects Injurious to Vegetation" (p. 120). These species are:

Microrhopala vittata Fab., living on Golden Rod. *Odontota rubra* Web., living on Apple, etc. *Odontota dorsalis* Thunb. living on Locust. They all occur in this neighborhood as do several other species belonging to the tribe, but according to Mr. Wm. Beutenmüller's "Catalogue of Transformations" (Journ. N. Y. Micros. Soc. VII. pp. 1–52) no further record has been made of their habits.

I am now able to add some notes on our Staten Island species and especially on the larvæ of *Odontota scapularis* Oliv.

Frequently in the woods, there grows freely a trailing vine of the Pulse family, identified for me by Mr. W. T. Davis as *Phaseolus helvolus* (or in the last edition of Gray's Manual *Strophostylus peduncularis* Ell.) Its leaves are often marred by white blotches, the parts affected consisting only of the colorless epidermis of the leaf, its substance having been devoured by the larva of the *Odontota*. In early June the beetles are found upon these plants in copulation or perhaps the female in the act of ovipositing. The eggs are irregular, rough, black masses, about one millimeter in diameter and are attached to the under side of the leaf, usually singly. The larvæ are oblong, flattened, somewhat cuneiform in outline, soft and of a whitish color except the head which is piceous and corneous. They are, of course, minute when first hatched, but continue to grow larger, always living within the leaf and enlarging the white blotch as they eat, until by September they have attained a length of one-fourth inch. The pupal stage is probably of short duration. The beetle is black, roughly sculptured, and has the humeral angles reddish. It is, from an ignorance of its habits perhaps, accounted rare by some collectors, but in the woods of Middletown and in Britton's woods, where its food plant grows freely, it is during June one of the abundant insects, and late in the summer still occurs.

Microrhopala vittata, living on Golden Rod, oviposits and perfects its transformation earlier than the *Odontata* and frequently three or four larvæ inhabit the same leaf. *Solidago canadensis* is especially

favored by this beetle and early in August the lower leaves will be found browned and entirely eaten, and in the pocket formed by the separation of their two surfaces after the larvæ have eaten away the interior are the freshly hatched beetles. From that date the second brood lives on the plants and eats the leaves into sieve-like forms, and now in October, the tops also appear to be attacked. They are closely imbricated and the beetles are nestling in the narrow crevices.

Several other species of the tribe live on Staten Island, but I am yet ignorant of their food plants.

Mr. Arthur Hollick called attention to the gratifying manner in which the law relating to the protection of song birds was being enforced in the country. During the past two weeks at least three gunners had been arrested and heavily fined. On October 1st, one Gustav Merle, of New York, was arrested and fined $140 by Justice Augustus Acker. He was caught with twenty-three dead birds in his possession, which Mr. Hollick assisted in identifying as follows: 8 high-holders (*Colaptes auratus*), 2 yellow-bellied wood-peckers (*Sphyrapicus varius*), 9 hermit thrushes (*Turdus pallasii*), 3 cat birds (*Mimus carolinensis*), and 1 titmouse (*Parus atricapillus*).

December 12th, 1891.—Informal meeting.

Mr. L. P. Gratacap, showed a thin section of the coarse trap rock from Lambert's Lane, mentioned in the proceedings of June 13, 1891, and read the following further memorandum in connection with it:

This coarse trap, previously alluded to as possibly containing hypersthene has been since examined microscopically and found to be a true diorite, made up of hornblende, plagioclase, feldspar and quartz, with traces of serpentization, due to alteration. It does not contain hypersthene. In hand specimens it is markedly different from the usual fine grained, compact trap from the Graniteville quarries and would not form as good a stone for road making and other economic uses as does the latter.

Mr. Gratacap also presented the following views in regard to the trap dike and its possible influence on the water supply of the region:

The trap dike on our island, which expands into a widened area at the Elm Park quarry, passes from that point south-westerly in a narrowed ridge, scarcely observable beneath the mantle of drift which covers it until at Graniteville it again is distended into a dome-like nucleus, which extends to the east-ward to the Church road, at Krumm's tavern, where the trap rock is only some seven feet or less below the surface. From this point it sinks and is found again on the

surface south of Lambert's Lane, where the road ascends its somewhat steeply sloping sides. Now the question seems an interesting one whether the springs on the north-west side of the trap ridge may not be regarded as flowing from heads of water in New Jersey, as the trap dike would seem to preclude the derivation of their supply from the water shed of the hilly parts of the Island. The low flat lands enclosed in the curved arm of the trap, which, as is well known, stretches out into Long Neck, is mainly a sandy region and I think does not possess the arrangement of impervious drift clay and water-bearing gravels noticeable in our water-bearing district. Just a few rods from Graniteville, on the Old Place road, there rises a spring which seems to come up on the eastern wall of the trap, and at Lambert's Lane, where the coarse trap rock crops out on the surface, a spring comes up on the west side of the trap. Do these two springs acquire the hydrostatic pressure which makes them spring from different quarters, and in each case is the wall of trap the cause of their rising where they do? Furthermore the ridge south of Long Neck, and separated from the latter by a shallow hollow, up which an arm of the Fresh Kills extends, so exactly imitates the low, rounded and long dome-like back of Long Neck itself and so suggests that there is a bifurcation of the trap ridge, or a parallel vent at this point, and if so the wells of the Crystal Water Works, at the end of this ridge, are also separated from the water shed of the Island by a trap wall and may represent a water source situated in New Jersey. Springs are found on either side of this suppositional second (?) trap flow and it may form a deep-seated barrier between two different areas of water drainage, the area north and west of it belonging to New Jersey, the area south or east of it probably insular.

Mr. Arthur Hollick called attention to the fact that in a paper entitled "A Few Words About Our Water Supply," published in the Staten Island Magazine for August 1888, the relation of the trap dike to the water supply was commented upon in the following words: "I can well remember the mystery which was supposed to be inseparable from the source of the springs [east of the trap ridge] * * * * some persons even went as far as the Orange Mountains in New Jersey to account for them, utterly ignoring the fact that the immense trap dike, which begins at the Palisades, forms Bergen Neck, crosses the Kills and extends through our Island from Port Richmond to Linoleumville, entirely cuts them off from this source."

Mr. Hollick remarked that it was a matter of considerable interest to find that two observers had arrived independently at practically

the same conclusions in regard to the trap dike as a barrier between different water sheds.

Pieces of a drift bowlder of Lower Helderberg limestone, found at Arrochar, was shown by Mr. Gratacap, in which the following fossils were identified: *Meristina arcuata* Hall; *Spirifera macropleura* Conrad; *Strophodonta beckii* Hall; *Strophomena rhomboidalis* Wahl; *Orthis subcarinata* Hall; *Eatonia medialis* Vanuxem; *Cœlaspira concava* Hall; *C. imbricata* Hall; and *Gosselettia mytilimera* Conrad. The last five not previously reported from the Island. Also portions of a similar bowlder from the shore of Tottenville, containing *Tentaculites gyracanthus* Eaton, and *Fistulipora?* sp.?, both new to the Island.

A note from Mr. Ira K. Morris was read, in which he stated that the sketch of old Richmond County Hall, from which was prepared the cut printed in the proceedings of September 12th, 1891, was made in September 1890. The building has since been entirely torn down.

SCIENTIFIC NEWS.

—Dr. Wilhelm Karl von Nageli, the late keeper of the Botanical Museum and Garden in Munich, who died recently in his seventy-fourth year, was a Swiss by birth. He was for some years Professor of Botany at the University of Zurich, but in 1857 was invited by King Maximilian II to the post which he so long occupied. He was a many-sided man, a great mathematician and microscopist, as he showed in his *Das Mikroskop.* His contributions to Alpine botany are numerous. The post darwinian form of the doctrine of Evolution found an energetic opponent in Nageli. The Swiss papers give a long list of his works. His study throughout life, as he said, was to understand the " very least of the very little."

—C. W. Stiles has been elected to the Societe de Biologie (Paris) to the vacancy caused by the death of Prof. Leidy (Membre correspondant etranger).

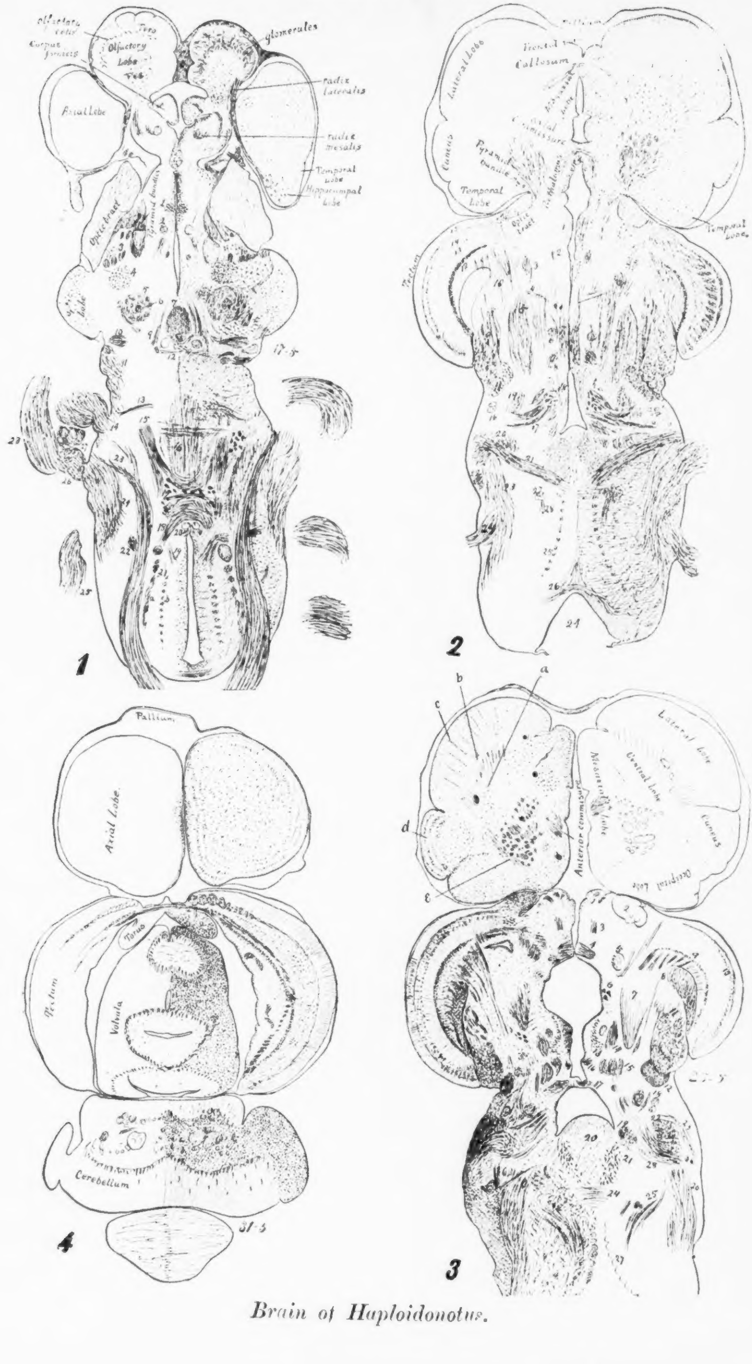
—The company quarrying limestone on Kelley Island, Lake Erie, has presented to the Western Reserve Historical Society of Cleveland, a portion of the remarkable glacial grooves at that locality. Prof. G. F. Wright of Oberlin writes to the *Cleveland Leader* as follows:

The direction of these grooves is a little south of west, corresponding to that of the axis of the lake. This is nearly at right angles to the

course of the ice scratches on the summit of the watershed south of this, between the lake and the Ohio River. The reason for this change of direction can readily be seen by a little attention to the physical geography. The high lands to the south of the lake rise about seven hundred feet above it. When the ice period was at its climax, and overran these high lands, it took its natural course at right angles to the terminal moraine, and flowed south-east, according to the direction indicated by the scratches on the summit. But when the supply of ice was not sufficient to overrun the high lands, the obstruction in front turned the course, and the result was a motion towards Toledo and the Maumee Valley, where, in the vicinity of Fort Wayne, an extensive terminal moraine was formed. The grooves on the islands near Sandusky were produced during that stage in the recession of the great ice-sheet.

The groove preserved is only a small portion of what still exists. But it would be too much to ask to have more given by the company. As it is, the public spirit shown by the directors, gathered from Boston to Duluth, has rarely been equaled by a similar corporation. Quarrying has already proceeded nearly all around this specimen, and soon the monument preserved will be a monument indeed; the groove being left to cap a pedestal about thirty feet high, and conspicuous from every side. About one-half the surface will be cleared of debris, so as to show fifty feet of the length of the groove, while the other half will remain as it is, beneath its protective covering of pebbles, gravel, sand, and mud, which acted as the graving tools in the firm grasp of ice. In this condition it is to be presented to the Western Reserve Historical Society of Cleveland to remain for the admiration and instruction of all future generations. I trust the citizens of the vicinity will appreciate the noble gift enough to occasionally visit the place and receive the deep impressions it is so well calculated to make.

PLATE VII.



Brain of Haploidonotus.